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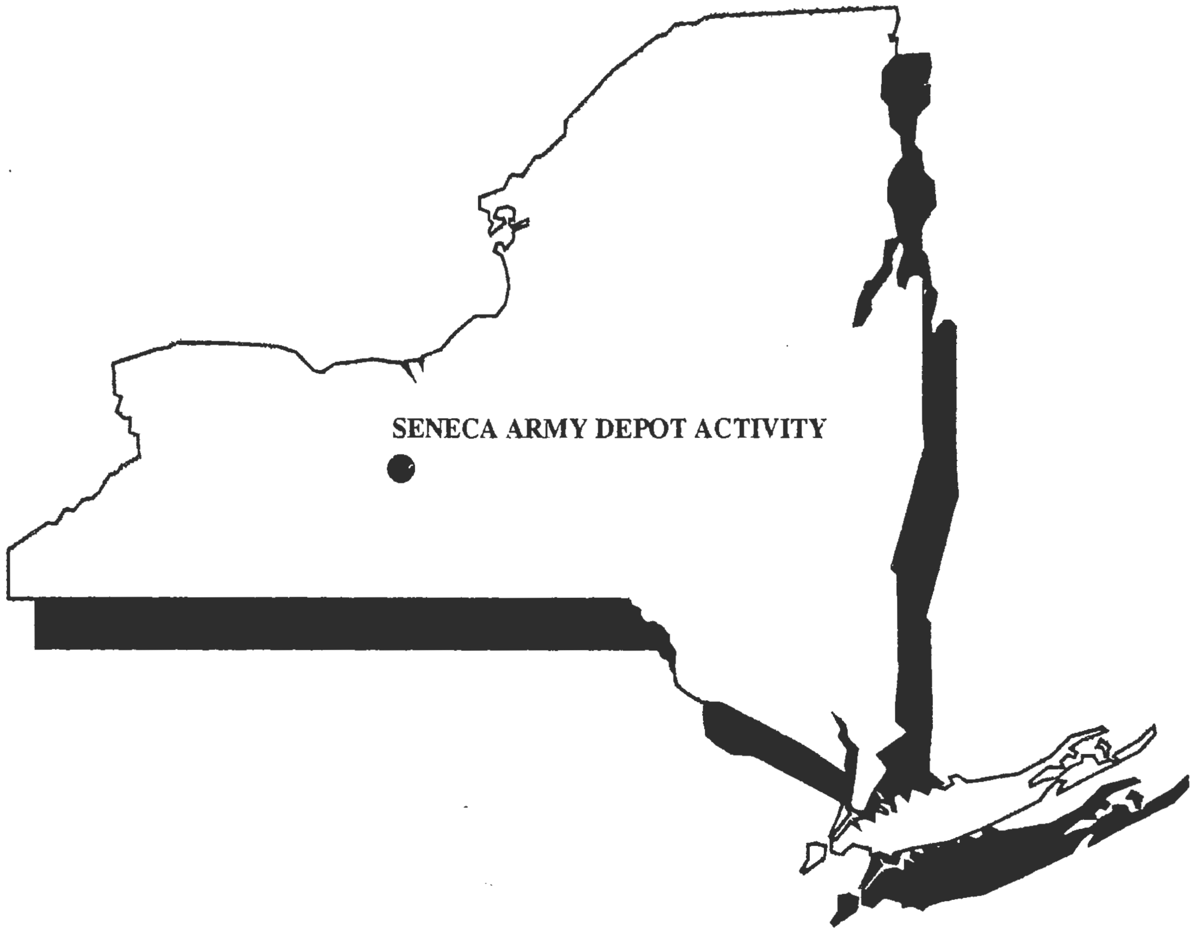
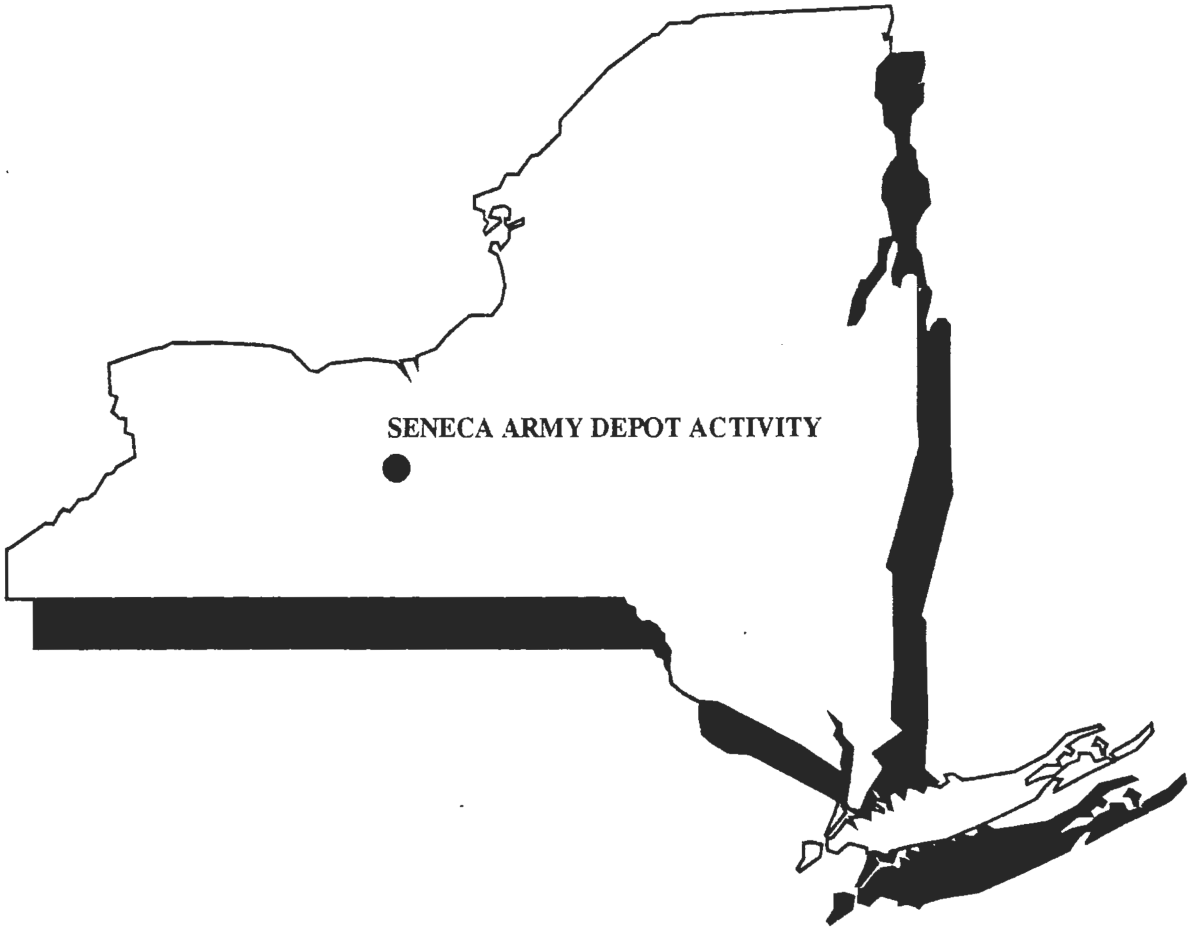


FINAL

REMEDIAL INVESTIGATION REPORT AT THE ABANDONED DEACTIVATION FURNACE (SEAD -16) AND THE ACTIVE DEACTIVATION FURNACE (SEAD-17)

MARCH 1999

U.S. ARMY ENGINEER DIVISION
HUNTSVILLE, ALABAMA



FINAL

REMEDIAL INVESTIGATION REPORT AT THE ABANDONED DEACTIVATION FURNACE (SEAD -16) AND THE ACTIVE DEACTIVATION FURNACE (SEAD-17)

MARCH 1999

PARSONS ENGINEERING SCIENCE, INC.

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

April 12, 1998

Ms. Alicia Allen
CEHNC-PM-ND
U.S. Army Engineering and Support Center
4820 University Square
Huntsville, AL 35816

SUBJECT: **Submittal of the Draft-Final Remedial Investigation Report at the Abandoned Deactivation Furnace Building (SEAD-16) and the Active Deactivation Furnace Building (SEAD-17)**

Dear Ms. Allen:

Parsons Engineering Science (Parsons ES) is please to submit the Draft-Final Remedial Investigation (RI) Report at the Abandoned Deactivation Furnace Building (SEAD-16) and the Active Deactivation Furnace Building (SEAD-17) at the Seneca Army Depot Activity located in Romulus, New York. The RI report is comprised of two volumes, the text and the appendices. This work was performed in accordance with the Scope of Work (SOW) for Delivery Order 0003 to the Parsons ES Contract DACA87-95-D-0031. This submittal has also been provided under separate cover to Ms. Carla Struble at EPA and Mr. Jim Quinn at NYSDEC.

Parsons ES appreciates the opportunity to work with the USACE on this important project and looks forward to a continued relationship on this and other projects. Please feel free to call me at (781) 401-2492.

Sincerely,

PARSONS ENGINEERING SCIENCE, INC.

Michael Duchesneau

Michael Duchesneau, P.E.
Project Manager

Attachments

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cc: Mr. Randall Battaglia, CENAN
Mr. Keith Hoddinott, USACHPPM (Prov.)
Mr. John Buck, USAEC
Mr. Jim Quinn, NYSDEC
Mr. Don Williams, CEMRD
Mr. Stephen Absolom, SEDA
Ms. Carla Struble, USEPA
Mr. Edward Agy, AMSIO-EQE

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ABS	Absorption Fraction
ACBM	Asbestos Containing Building Material
AET	Actual Evapotranspiration
AMC	U.S. Army Material Command
AOC	Area of Concern
AQCR	Genesee-Finger Lakes Air Quality Control Region
1,2-DCA	1,2-Dichloroethane
1,2,-DCE	1,2-Dichloroethylene (total)
2,4,5-TP	Silvex
ARAR	Applicable or Relevant and Appropriate Requirements
AST	Aboveground Storage Tank
ASTM	American Society for Testing and Materials
AW	Drilling Rod Size
ATSDR	Agency for Toxic Substances and Disease Registry
AWQC	Ambient Water Quality Criteria
B	Boring
BAF	Bioaccumulation Factor
BALAT	Benthic Aquatic Life Acute Toxicity Criteria
BALCT	Benthic Aquatic Life Chronic Toxicity Criteria
BAP	Benzo(a) Pyrene
BCF	Bioconcentration Factor
BDL	Below Detection Limit
bls	below land surface
BOD	Biological Oxygen Demand
BRA	Baseline Risk Assessment
BRAC	Base Realignment and Closure
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
C	Carcinogenic Risk
CEC	Cation Exchange Capacity

CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CI	Chloride
CLP	Contract Laboratory Program
cm	Centimeters
cm/sec	Centimeters per second
CME	Central Mine Equipment
COC	Chemical of Concern
COD	Chemical Oxygen Demand
COPC	Chemical of Potential Concern
CRAVE	USEPA Carcinogen Risk Assessment Verification Endeavor
CRT	Cathode Ray Tube
CSM	Conceptual Site Model
CT	Central Tendency
CV	Coefficient of Variance
DCE	Dichloroethylene
DDD	1.1-Dichloro - 2-(o-chlorophenyl) - 2-(p-chlorophenyl)
DDE	1.1-Dichloro - 2-(p-chlorophenyl) - 2-(o-chlorophenyl)
DDT	1.1.1-Trichloro - 2-(0-chlorophenyl) - 2-(p-chlorophenyl) ethane
DES	Diethyl Stilbestrol
DO	Disolved Oxygen
DOD	Department of Defense
DOE	Department of Energy
DOT	Department of Transportation
DWQS	Drinking Water Quality Standard
Eh	Oxidation Reduction Potential
EEC	Expected Exposure Point Concentration
EF	Exposure Factors
EIS	Environmental Impact Statement

EM	Electromagnetic
EMSOFT	Emission Model for Soil Organic Fate and Transport
EPA	Environmental Protection Agency
EPC	Explosive Point Concentration
EPM	Equivalent Porous Media
EPT	Ephemeroptera, Plecoptera and Tricoptera
EQ	Ecological Quotient
ERA	Ecological Risk Assessment
ERQ	Ecological Risk Quotient
ES	Engineering-Science, Inc.
ESE	Environmental Science and Engineering
ESF	Environmental Science and Forestry
ESI	Expanded Site Inspection
FDA	Food and Drug Administration
FI	Fraction Ingested
FMP	Forest Management Plan
FS	Feasibility Study
ft	Feet
ft/day	Feet per day
ft/ft	Feet per foot
ft/sec	Feet per second
ft/yr	Feet per year
FWMP	Fish and Wildlife Management Plan
FWIA	Fish and Wildlife Impact Analysis
g	gram
GAE	Geophysical anomaly excavations
GC	Gas chromatograph
GC/MS	Gas chromatograph/Mass spectrum
gpm	Gallons per minute
GPR	Ground penetrating radar

GSSI	Geophysical Survey Systems, Inc.
HEAST	Health Effects Assessment Summary Tables
HHB	Human Health Bioaccumulation Criteria
HI	Hazard Index
HMX	Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine
HQ	Core Barrel Size
HSDB	Hazardous Substances Data Bank
I	Infiltration
ICF	ICF Technology, Incorporated
IR	Ingestion Rate
IRIS	Integrated Risk Information System
IRP	Installation Restoration Program
LEL	Lowest Effect Level
LOAEL	Lowest Observed Adverse Effect Level
LOT	Limit of Tolerance
L/min	Liters per minute
m	meter
MCPA	4-Chloro-2-Methylphenoxy acetic acid
MCRW	Microwell
MCPP	4-Chloro-2-Methylphenoxy-2-propionic acid
mg/kg	Milligrams per kilogram
mg/L	Micrograms per liter
mg/m_3	milligrams/cubic meter
MHz	Megahertz
MIE	Monitoring Instruments for the Environment, Inc.
mi	mile
ml	milliliter
ML	Inorganic Silt
mL/g	milliliter per gram

mmhos/m	Millimhos per meter
mmHg	Millimeters Mercury
MRD	Missouri River Division
m/s	meter per second
MSL	Mean sea level
MW	Monitor Well
NAVA	North American Vertical Datum
NBS	National Bureau of Standards
Nc	Noncarcinogenic
NOAA	National Oceanic Atmospheric Administration
NOAEL	No Observed Adverse Effect Level
NO_2/N	Nitrite-Nitrogen
NO_3/N	Nitrate-Nitrogen
NPL	National Priority List
NRMP	National Resources Management Plan
NSF	National Sanitation Foundation
NTU	Nephelometric turbidity units
NW	Drilling Rod Designation
NWI	National Wildlife Institute
NYCRR	New York Codes, Rules and Regulations
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OB	Open Burning
ODAST	One Dimensional Analytical Solute Transport
OU	Operational Unit
OV	Specific Ovid Quadrangle
OVM	Organic Vapor Meter
PAH	Polynuclear aromatic hydrocarbons

PCB	Plychlorinated Biphenyls
PDM	Miniature Real-time Aerosol Monitor Model
PERC	Percolation
PET	Potential Evapo Transpiration
PID	Photoionization detector
ppm	parts per million
ppmv	Part Per Million Per Volume
PR	Percent Recovery
PSCR	Preliminary Site Characterization Report
Psi	Pounds per square inch
PT	Monitoring Well
PVC	Polyvinyl Chloride
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QC	Quality Control
RAGS	Risk Assessment Guidance for Superfund
RCRA	Resource Conservation and Recovery Act
RF	Response Factor
RfC	Reference Concentration
RfD	Reference Dose
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
RPD	Relative Percent Difference
RQD	Rock Quality Designation
SAF	Society of American Foresters
SARA	Superfund Amendments and Reauthorization Act
SB	Soil Boring
SCS	Soil Conservation Service
SD	Sediment
SDEF	Standard Default Exposure Factors

SDG	Sample Delivery Group
SEAD	Seneca Army Depot (old name)
SEDA	Seneca Army Depot
Sec	Seconds
SF	Slope Factor
SFF	Site Foraging Factor
SI	Site Investigation
SIPT	Seismic Interpretation Program Terminal
SIR	Subsurface Interface
SKC	Supplier of Air Sampling Equipment
SO_4	Sulfate
SOP	Standard Operating Procedures
SOW	Scope of Work
SQL	Sample Quantitator Limits
ST	Soil Moisture
STF	Soil Transport and Fate
SUNY-ESF	State University of NY College of Environmental Science and Forestry
SVOCs	Semi-Volatile Organic Compounds
SW	Sediment and surface water sample station
SWMU	Solid Waste Management Unit
TAGM	New York State Chemical And Administrative Guidance Memorandum
TAL	Target analyte list
TCL	Target compound list
TEC	Toxicological Endpoint Concentration
TEF	Toxicity Equivalency Factor
TES	Target Environmental Services, Inc.
TIC	Tentatively Identified Compound
TKN	Total Kjeldah/Nitrogen
TOC	Total Organic Carbon
TOX	Total Organic Halogens
TP	Test Pit
TPH	Total Petroleum Hydrocarbons

TRPH	Total Recovered Petroleum Hydrocarbons
TRV	Toxicity Reference Value
TS	Total Solids
ug/g	Micrograms per gram
ug/wp	Micrograms per wipe
ug/kg	Micrograms per kilogram
UCL	Upper Confidence Limit
URF	Unit Risk Factor
USACE	United States Army Corps of Engineers
USAEHA	United States Army Environmental Hygiene Agency
USATHAMA	United States Army Toxic and Hazardous Materials Agency
USCS	Unified Soil Classification System
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UST	Underground Storage Tank
UV/VIS	Ultraviolet/Visible
UXB	Unexploded Ordnance Clearance Subcontractor
UXO	Unexploded Ordnance
VLF-EM	Very Low Frequency Electromagnetic
VOA	Volatile organic analyte
VOC	Volatile Organic Compound
Vs	Volt Second
WB	Wildlife Bioaccumulation
WRS	Wilcoxon Rank Sum Test

DATA QUALIFIERS

EPA - defined qualifiers for Organic Analyses are as follows:

B - This flag is used when the analyte is found in the associated blank as well as in the sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

C - This flag applies to pesticide results where the identification has been confirmed by GC/MS.

D - This flag identifies all compounds identified in an analysis at a secondary dilution factor. If a sample or extract is re-analyzed at a higher dilution factor, as in the "E" flag above, the "DL" suffix is appended to the sample number for the diluted sample, and all concentration values reported are flagged with the "D" flag.

E - This flag identifies compounds whose concentrations exceed the calibration range of the GC/MS instrument for that specific analysis.

J - Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed, or when the mass spectral data identification criteria but the result is less than the sample quantitation limit but greater than zero.

L - The analyte is a suspected laboratory contaminant. It's presence in the sample is unlikely (applies to volatile and semi-volatile organic results).

S - The compound was detected above instrument saturation levels (applies to semi-volatile organic results).

U - Indicates compound was analyzed for but not detected.

X - The reported result was derived from instrument response outside the calibration range (applies to pesticide/PCB results).

Y - The reported result is below the specified reporting limit (applies to pesticide/PCB results).

EPA - qualifiers for Inorganic Analyses are as follows:

B - Concentration qualifier which indicates that the reported value was obtained from a reading that was less than the Contract Required Detection Limit (CRDL) but greater than or equal to the Instrument Detection Limit (IDL).

U - The analyte was analyzed for but not detected.

INTRODUCTION

All data in this appendix have been validated using EPA Region II data validation guidelines. These guidelines prescribe the use of the following qualifiers:

U	The analyte was not detected.
UJ	The analyte was not detected; however, the associated reporting limit is approximate.
J	The analyte was positively identified; however, QC results indicate that the reported concentration may not be accurate and is therefore an estimate.
R	The analyte was rejected due to laboratory QC deficiencies, sample preservation problems, or holding time exceedance. The presence or absence of the analyte cannot be determined.

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1.0 INTRODUCTION

1.1 PURPOSE OF REPORT

This report describes the Remedial Investigation (RI) activities at SEAD-16 and SEAD-17 at the Seneca Army Depot Activity (SEDA) in Romulus, New York. The purpose of this report is to discuss the physical characteristics of the sites, present and interpret the analytical results from the investigation programs, identify sources of the potential impacts at these sites and estimate the potential risk to human health and the environment. SEDA is included on the federal facilities National Priorities List (NPL) and has been listed since July 13, 1989.

Parsons Engineering Science, Inc. (Parsons ES) has been retained by the United States Army Corps of Engineers (USACE) as part of their remedial response activities under the Comprehensive Environmental Responsibility, Compensation and Liability Act (CERCLA) to perform these activities.

1.2 GENERAL DESCRIPTION OF SEDA

SEDA is an active military facility constructed in 1941. The site is located approximately 40 miles (mi) south of Lake Ontario, near Romulus, New York (Figure 1-1). The facility is located in an uplands area, at an elevation of approximately 600 feet Mean Sea Level (MSL), that forms a divide separating two of the New York Finger Lakes, Cayuga Lake on the east and Seneca Lake on the west. Sparsely populated farmland covers most of the surrounding area. New York State Highways 96 and 96A are roughly adjacent to SEDA's eastern and western boundaries, respectively. Since its inception in 1941, SEDA's primary mission has been the receipt, storage, maintenance, and supply of military items. SEAD-16 (Building S-311 Abandoned Deactivation Furnace) and SEAD-17 (Building 367 Deactivation Furnace) comprise only a few acres within the 10,587 acres that make up the entire SEDA facility. Figure 1-2 presents a plan view of SEDA and identifies the locations of the SEAD-16 and SEAD-17.

The depot is divided into three areas. The main Post accounts for 9,832 acres and consists of an exclusion area containing partially buried, reinforced, concrete igloos, general storage magazines, and warehouses. The cantonment areas of the facility consist of the North and South Posts. The North Post, at the north end of the Main Post, includes former troop housing, troop support and community service facilities. The South Post is located in the south-eastern portion of the facility

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CLIENT/PROJECT TITLE

SENECA ARMY DEPOT ACTIVITY
RI/FS
SEAD-16 and SEAD-17

DEPT ENVIRONMENTAL ENGINEERING

DWG NO. 729895-01001

FIGURE 1-1

LOCATION MAP

SCALE 1"= 8 MILES APPROX.

DATE NOVEMBER 1996

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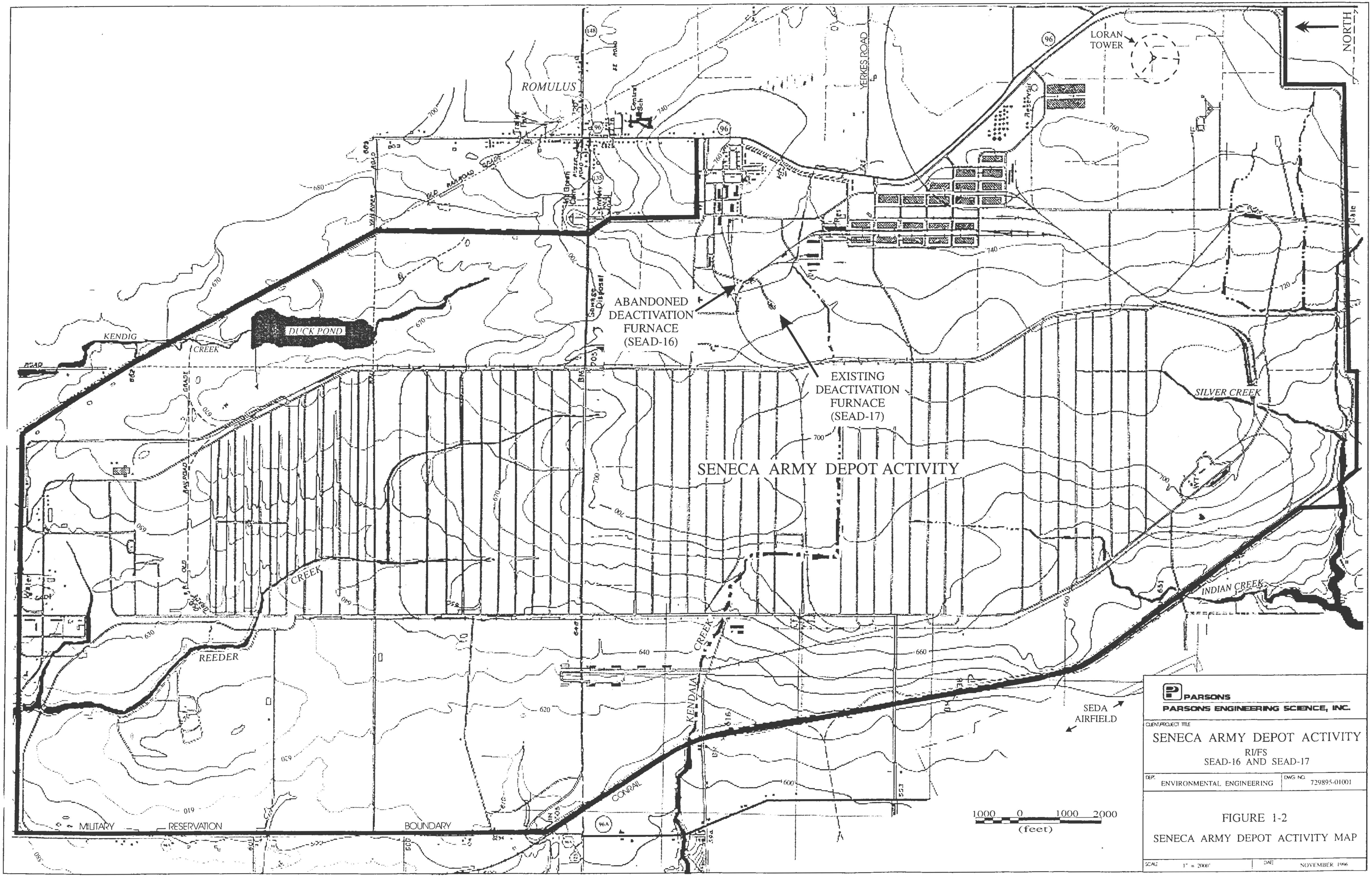

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SENECA ARMY DEPOT ACTIVITY

RI/FS

SEAD-16 AND SEAD-17

DEPT. ENVIRONMENTAL ENGINEERING

DWG NO. 729895-01001

FIGURE 1-2

SENECA ARMY DEPOT ACTIVITY MAP

SCALE 1" = 2000'

DATE NOVEMBER 1996

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near Rt. 96 and is a developed area containing warehouses, administration buildings, quarters, and community services.

1.3 SEAD-16

1.3.1 General Site Description

The Abandoned Deactivation Furnace (Building S-311) is located in the east-central portion of SEDA and situated on approximately 2.6-acres of fenced land (Figure 1-3). Directly to the northwest of Building S-311, and separated by two sets of SEDA railroad tracks which pass through the site, is a smaller abandoned building, the Process Support Building (Building 366) (Figure 1-3). The site is composed of grasslands to the north, east, and west and by a general storage area for empty boxes and wooden debris and an unpaved roadway to the south. Railroad tracks transect the site in a north-south direction. Two sets of tracks parallel Building S-311 on the northeastern side and a spur runs to the loading dock on the northwestern corner. Vehicle access to Building S-311 is provided via an unpaved road that intersects Administration Avenue 1,500 feet east of the site.

The Abandoned Deactivation Furnace (Building S-311) is an elongated building with two emission stacks located on the eastern and western ends (Figure 1-3). The stack on the western end was used for boiler emissions and the stack on the eastern end was used for furnace emissions. Building S-311 is composed of several rooms. The deactivation furnace was located in the southeastern end of the building. Also, two boilers are located in the southeastern corner of the building. Generally, the building is in poor condition and there is localized flooding in the basement.

The Process Support Building (Building 366), which was used for propellant/powder collection, is composed mostly of corrugated sheet metal (southern end) and brick (northern end). This building is mostly dilapidated. This building was used for storage and process support for munitions deactivation, which occurred in the furnace located in Building S-311. Overhead piping that connects the two buildings likely carried slurry mixtures.

Two underground storage tanks (USTs) formerly existed at Building S-311. One of the USTs (Tank 311-A), which had a capacity of 1,000 gallons, was installed in 1953 and was located immediately northwest of the building. This UST provided #2 fuel oil to the boiler used to heat the building. The second UST (Tank 311-B) had a 2,000-gallon capacity and was also installed in 1953. This UST was located immediately southwest of the building and provided #2 fuel oil to the deactivation furnace. Both of the tanks were removed in September of 1992. The underground storage tank report is contained in Appendix A.

There are several utilities on the site. A water main traverses the southwestern portion of the site with a service line leading to the northwestern side of the Building S-311. An abandoned sewer line enters the site from the northeast, approximately 50 feet south of the access gate, and connects to the central portion of the Building S-311.

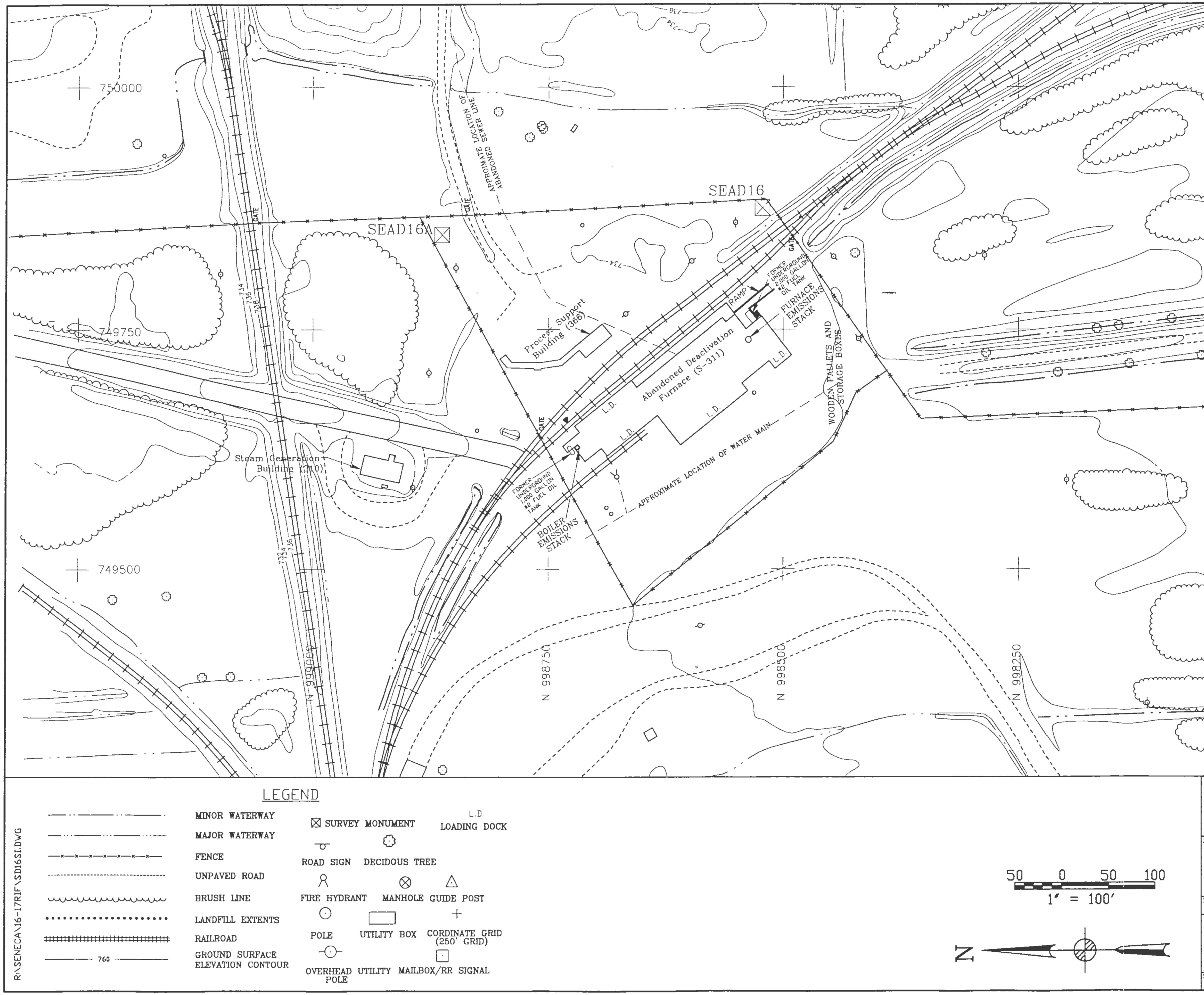
1.3.2 Site History

SEDA, constructed in 1941, has been owned by the United States Government and operated by the Department of the Army since its construction. Prior to construction of the depot, the site was used for farming.

The Abandoned Deactivation Furnace, (SEAD-16) located in Building S-311, was used to destroy munitions from approximately 1945 to the mid-1960s. Small arms munitions, both obsolete and unserviceable, were destroyed by incineration. There were no air pollution or dust control devices installed on the furnace during the time that it operated. The overhead pipes connecting Buildings S-311 and 366 were used to convey propellants in the deactivation process; it is also likely that propellants were stored in these buildings.

1.3.3 Previous Investigations

SEAD-16 is described in four previous reports. The first report is a SWMU Classification Report (Parsons ES, 1994a) that describes and evaluates the Solid Waste Management Units at SEDA. This report was an initial step to provide a cursory evaluation of all of the SWMUs at SEDA. The second report is the Work Plan for CERCLA Expanded Site Inspection (ESI) of Ten Solid Waste Management Units (SWMUs) written by Parsons Main, Inc. in 1993. This report detailed the site work and sampling to be performed for the ESI. The third report is an Expanded Site Inspection



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SENECA ARMY DEPOT ACTIVITY
RI/FS
SEAD-16 ABANDONED DEACTIVATION FURNACE

DEPT.	Dwg. No.
ENVIRONMETAL ENGINEERING	729895-01001

FIGURE 1-3
SEAD-16 SITE PLAN

SCALE	DATE	REV
1" = 100'	DECEMBER 1996	A

Report (Parsons ES, 1995a) that presents the results of a more detailed investigation of SEAD-16. The fourth report is a Final Closure Report for the Underground Storage Tank Removal at Seneca Army Depot Activity, Romulus, New York (Science Applications International Corporation, May 1994) that describes the removal and sampling for the two USTs at SEAD-16 and presents the confirmatory sampling records and chemical analyses associated with the closure process. The results of these investigations at SEAD-16 are summarized below.

SWMU Classification Report

The SWMU Classification Report (Parsons ES, 1994a) provides limited information about SEAD-16, as this report was designed to briefly describe and evaluate all 72 of the SWMUs at SEDA while also providing recommendations for future action at these sites. This report describes SEAD-16 (the Abandoned Deactivation Furnace), its physical make-up, the waste characteristics associated with it, as well as other information related to migration pathways and exposure potential. The report recommended that a CERCLA Site Inspection (SI) be performed at SEAD-16 as part of the investigation of 10 Solid Waste Management Units at SEDA. At the time of the preparation of the SWMU Classification Report, SEAD-16 was classified as a High Priority Area of Concern.

Expanded Site Inspection Report

The fieldwork for the ESI was conducted according to the Work Plan for CERCLA Expanded Site Inspection (ESI) of Ten Solid Waste Management Units (SWMUs) (Parsons Main, Inc., 1993). Based on this work, a report entitled Expanded Site Inspection, Seven High Priority SWMUs, SEAD-4, -16, -17, -24, -25, -26, and -45 was prepared by Parsons ES, (May 1995a), and submitted to both NYSDEC and the USEPA.

The ESI conducted at SEAD-16 consisted of geophysics, soil sampling, monitoring well installation, groundwater sampling, standing water sampling and interior building material sampling. These investigations were used to initially characterize the physical setting of the site and determine whether soil and/or groundwater had been impacted by releases of chemicals from paste site activities. Seismic profiles performed on the flanks of the site were successful in determining that the bedrock surface slopes to the southwest, generally following the slope of the ground surface, and that groundwater flow was also likely to be in this direction.

The ESI conducted at SEAD-16 indicated that impacts to the surface soils from the release of heavy metals and SVOCs have occurred at this site. In particular, the four metals copper, lead, mercury, and zinc were identified in surface soil samples at concentrations above the TAGM values. Elevated SVOC levels were also reported for some samples, although the concentrations were randomly distributed with no consistent pattern evident. The distribution of samples with elevated heavy metal concentrations also appears to be somewhat random at site. Nitroaromatic compounds, and in particular 2,4-dinitrotoluene, were identified in the majority of the soil samples collected at SEAD-16. While the concentrations were generally low, this compound was identified in more than half of the soil samples collected. No TAGM value currently exists for this compound.

Within the building, elevated metals and SVOCs were also identified. Asbestos was also identified within some of the building materials sampled. The analysis of the standing water present in the building showed that constituents had not partitioned into the surface water within the building.

The results of the groundwater investigation at SEAD-16 identified levels of chromium, copper, lead, and zinc in some of the groundwater samples collected at SEAD-16. It was difficult to determine if groundwater had been impacted at this site as the analytical results were skewed by high sample turbidities. The analytical results from the ESI will be discussed further in Section 4.0.

Closure Report, Underground Storage Tank Removal

This report describes the removal of two underground storage tanks (Tanks 311-A and 311-B) from Building S-311. Both tanks were removed, cleaned, dismantled, and disposed of in accordance with information presented in the NYSDEC *Spill Technology and Remediation Series* (*STARS*) 1992 guidance. As stated in this report, Tank 311-A appeared to be in good structural condition and did not leak. Soil samples collected from around the tank indicted that there were impacts from SVOCs (PAHs in particular), but the report stated that these PAHs were likely due to "emissions from the nearby boiler stack or the small-arms deactivation furnace located on the southern edge of Building S-311." Soil sampling associated with Tank 311-B indicated that one soil sample and one groundwater sample "showed evidence of contamination." The report also stated that the detected compounds are "byproducts of incomplete combustion." A complete copy of the underground storage tanks closure report is contained in Appendix A.

1.4 SEAD-17

1.4.1 General Site Description

The Existing Deactivation Furnace (Building 367) is located in the east-central portion of SEDA (Figure 1-4). Access to this site is restricted since it is located in the ammunition storage area. It is characterized by an elongated deactivation furnace building that is surrounded by a crushed shale road. The actual deactivation furnace is a steel rotary kiln incinerator and is enclosed by an eight foot high reinforced concrete wall. The wall does not contain a roof. The concrete wall is intended to contain the effects of a detonation. Beyond the crushed shale road is grassland. Two small sheds are located in the eastern portion of the site. The site is generally flat but slopes gently to the southwest.

A small drainage ditch is located approximately 100 feet east of the building and bends west past the southern end of the building, ending near a stand of brush and trees at the western boundary of the site.

1.4.2 Site History

The Existing Deactivation Furnace (SEAD-17), located in Building 367, has been active from 1962 to 1989. A dust collection system was added to the unit in 1978, and it was further upgraded in 1989. This facility has not operated since 1989, pending approval of the Part B application, which includes a Trial Burn Plan (TBP).

The deactivation furnace is used to incinerate obsolete and unserviceable small arms munitions (20 mm or less in size), fuses, boosters and firing devices. The furnace consists of a rotary steel kiln retort and feed discharge assemblies. The kiln has a cross-sectional area of 4.6 square feet and is 20 feet long. The kiln is fired by # 2 fuel oil. The furnace's feed system consists of a waste feed weighing system, a primary waste feed conveyor and a secondary conveyor. The furnace is equipped with an Air Pollution Control System (APCS). The APCS consists of an afterburner, gas coolers, cyclone separator, baghouse, compressor, induced draft fan, stack and associated duct work.

The furnace has been included in the facility's Part B permit application. The unit was upgraded in 1989 to meet the operating requirements for incinerators detailed in 40 CFR Part 264 Subpart O. As part of the RCRA regulations, interim closure of the unit was conducted in 1989. A plan for conducting a trial burn has also been prepared. The trial burn will be conducted after review and approval of the TBP by the NYSDEC and the USEPA.

Operating practices include placing unpacked ammunition on a conveyor for transfer to the deactivation furnace at prescribed intervals. The ammunition is burned and exploded by the heat in the furnace. The solid residue from the furnace is transferred by a conveyor to an approved hazardous waste container and allowed to cool. When cooled, the scrap metal is disposed of in barrels for transfer to the Defense, Reutilization and Marketing Office (DRMO).

1.4.3 Previous Investigations

SEAD-17 is described in three previous reports. The first report, the SWMU Classification Report (Parsons ES, 1994a), was undertaken to describe and evaluate the Solid Waste Management Units at SEDA. The second report is the Work Plan for CERCLA Expanded Site Inspection (ESI) of Ten Solid Waste Management Units (SWMUs) written by Parsons Main, Inc. in 1993. This report detailed the site work and sampling to be performed for the ESI. The third report is a Expanded Site Inspection Report (Parsons ES, 1995a) that describes a more detailed investigation of SEAD-17. The results of these investigations are summarized below.

SWMU Classification Report

This report, the SWMU Classification Report (Parsons ES, 1994a), provides limited information about SEAD-17, as it was designed to briefly describe and evaluate all 72 of the SWMUs at SEDA while also providing recommendations for future action at these sites. This report describes SEAD-17 (the Existing Deactivation Furnace), its physical make-up, the waste characteristics associated with it, as well as other information related to migration pathways and exposure potential. The report recommends that a CERCLA SI also be performed at SEAD-17 as part of the investigation of 10 Solid Waste Management Units at SEDA. At the time of the preparation of the SWMU Classification Report, SEAD-17 was classified similarly to SEAD-16, as a High Priority Area of Concern.

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CLIENT/PROJECT TITLE

SENECA ARMY DEPOT ACTIVITY
RI/FS
SEAD-17 ACTIVE DEACTIVATION FURNACE

DEPT	Dwg No
ENVIRONMENTAL ENGINEERING	729895-01001

FIGURE 1-4
SEAD-17 SITE PLAN

SCALE	DATE	REV
1" = 100'	DECEMBER 1996	A

Expanded Site Inspection Report

The fieldwork for the ESI was conducted according to the Work Plan for CERCLA Expanded Site Inspection (ESI) of Ten Solid Waste Management Units (SWMUs) written by Parsons Main, Inc. in 1993. This report detailed the site work and sampling to be performed for the ESI. Based on this work, a report entitled Expanded Site Inspection, Seven High Priority SWMUs, SEAD-4, -16, -17, -24, -25, -26, and -45 was prepared by Parsons ES (1995a) and submitted to both the NYSDEC and the USEPA.

The investigation at SEAD-17 consisted of geophysics, soil sampling, monitoring well installation and groundwater sampling. These investigations was used to initially characterize the physical setting of the site and determine whether soil and/or groundwater had been impacted by releases of chemicals from paste site activities.

Seismic profiles performed on the flanks of the site were successful in determining that the bedrock surface slopes to the west or southwest, generally following the slope of the surrounding land surface, and that groundwater flow is also likely to be in this direction. The water table elevations indicated that groundwater flow was essentially to the west.

The results of the ESI conducted at SEAD-17 indicated that impacts to the surface soils from the release of metals and SVOCs, have occurred at this site. In particular, the three metals copper, lead, and zinc were consistently identified in surface soil samples at concentrations above the TAGM values.

The results of the groundwater investigation at SEAD-17 identified elevated levels of iron, lead, magnesium, manganese and sodium in some of the groundwater samples collected at SEAD-17. It was difficult to determine if groundwater has been impacted at this site because the analytical results were skewed by high sample turbidities in several of the groundwater samples.

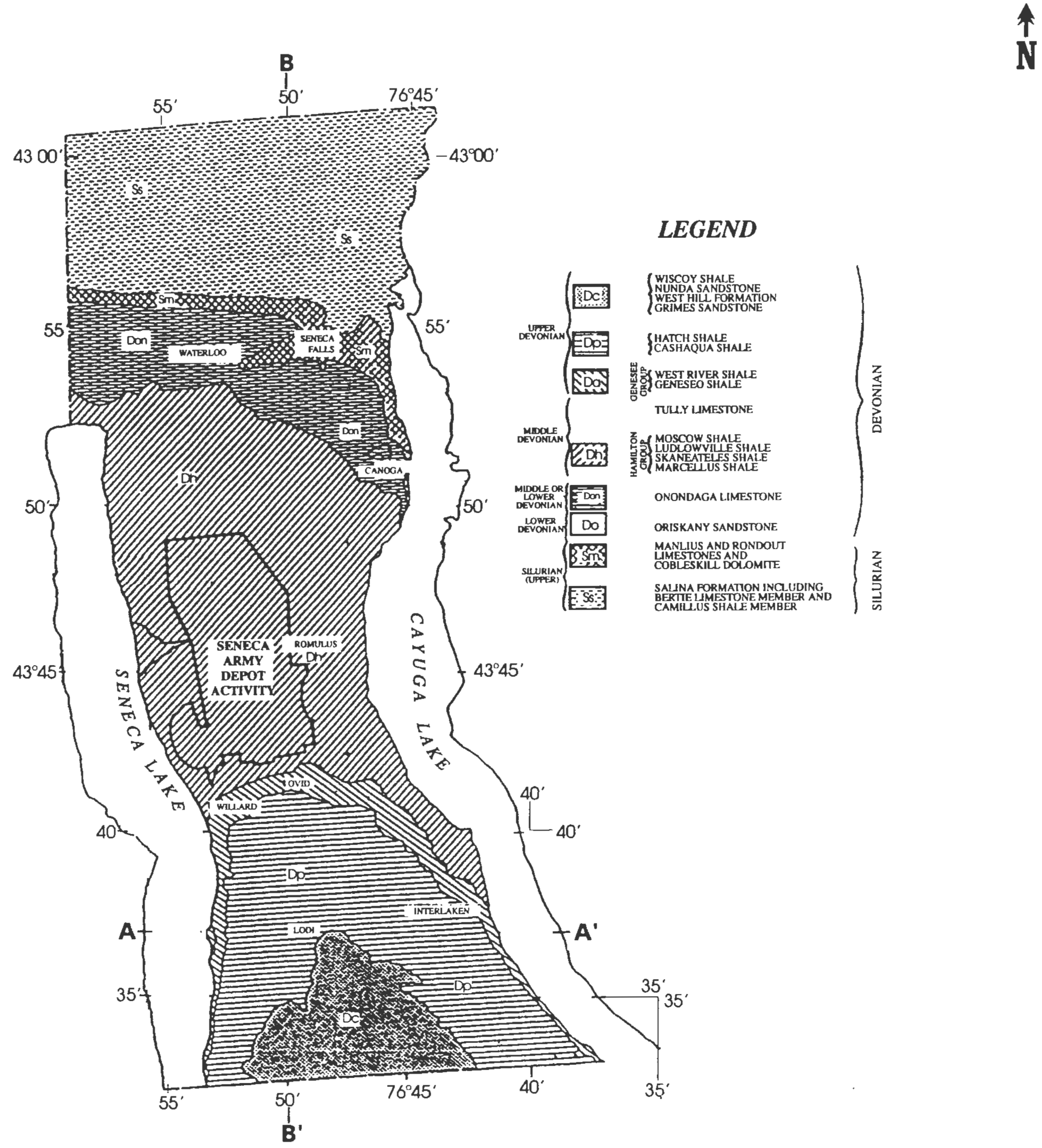
1.5 BACKGROUND INFORMATION

1.5.1 Regional Geologic Setting

The Finger Lakes uplands area is underlain by a broad north-to-south trending series of rock terraces mantled by till. As part of the Appalachian Plateau, the region is underlain by a technically undisturbed sequence of Paleozoic rocks consisting of shales, sandstones, conglomerates, limestones and dolostones. Figure 1-5 shows the regional geology of Seneca County. In the vicinity of SEDA, Devonian age (385 million years bp) rocks of the Hamilton group are monoclinally folded and dip gently to the south (Figure 1-6). No evidence of faulting or folding is present. The Hamilton Group is a sequence of limestones, calcareous shales, siltstones, and sandstones. These rocks were deposited in a shallow inland sea at the north end of the Appalachian Basin (Gray, 1991). Terrigenous sediments from topographic highs associated with the Acadian landmass of Western New England, eastern New York and Pennsylvania were transported to the west across a marine shelf (Gray, 1991). These sediments were deposited in a northeast-southwest trending trough whose central axis was near what is now the Finger Lakes (Gray, 1991).

The Hamilton Group, 600 to 1500 feet thick, is divided into four formations. They are, from oldest to youngest, the Marcellus, Skaneateles, Ludlowville, and Moscow formations. The western portion of SEDA is generally located in the Ludlowville Formation while the eastern portion is located in the younger Moscow Formation. The Ludlowville and Moscow formations are characterized by gray, calcareous shales and mudstones and thin limestones with numerous zones of abundant invertebrate fossils that form geographically widespread encrinites, coral-rich layers, and complex shell beds. The Ludlowville Formation is known to contain brachiopods, bivalves, trilobites, corals and bryozoans (Gray, 1991). In contrast, the lower two formations (Skaneateles and Marcellus) consist largely of black and dark gray sparsely fossiliferous shales (Brett et al., 1991). Figure 1-7 displays the stratigraphic section of Paleozoic rocks of Central New York.

The physiography of Seneca County is shown on Figure 1-8. The majority of the area between Seneca and Cayuga Lakes is characterized by a till plain, which encompasses the entire SEDA facility. The Appalachian Plateau encroaches on the southern portion of this area. To the north of SEDA, the till plain gives way to glacial lake sediments in and near the towns of Waterloo and



SOURCE: MODIFIED FROM-THE GROUND WATER RESOURCES OF SENECA COUNTY, NEW YORK: MOZOLA, A.J., BULLETIN GW-26, ALBANY, NY, 1951

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RI/FS

SEAD-16 and SEAD-17

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FIGURE 1-5

GEOLOGIC MAP OF SENECA COUNTY

SCALE 1" = 5 MILES	DATE NOVEMBER 1996

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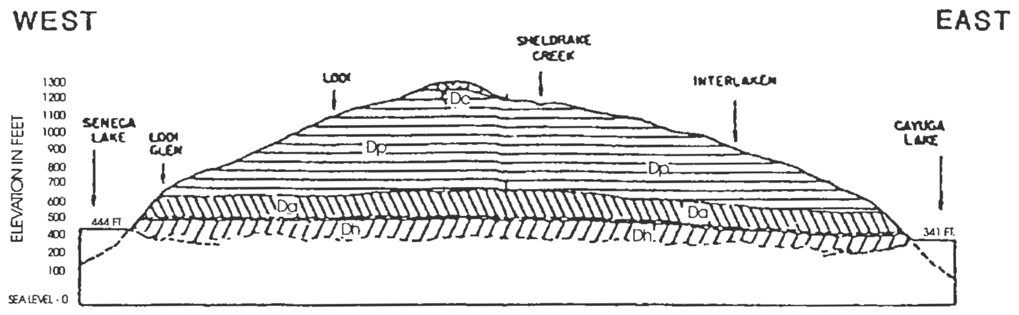
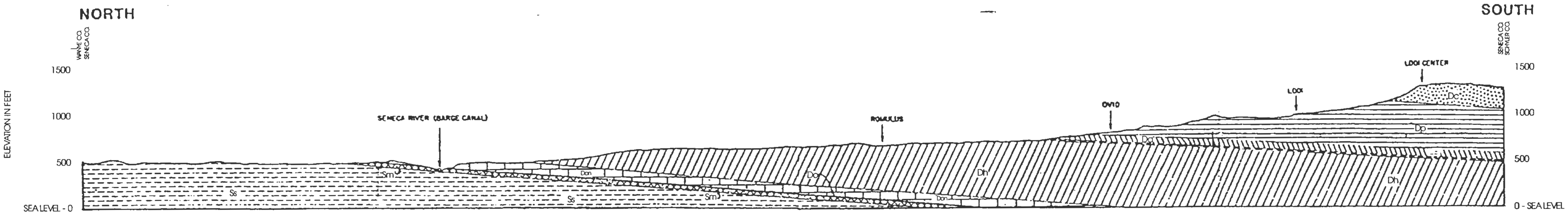


EAST-WEST SECTION ALONG A- A'



NORTH-SOUTH SECTION ALONG 76°50' (B-B')

LEGEND

UPPER DEVONIAN	Dc		WISCOY SHALE NUNDA SANDSTONE WEST HILL FORMATION GRIMES SANDSTONE	DEVONIAN
	Dp		HATCH SHALE CASHAQUA SHALE	
	Da	GENESEE GROUP	WEST RIVER SHALE GENESEO SHALE	
MIDDLE DEVONIAN			TULLY LIMESTONE	
	Dh	HAMILTON GROUP	MOSCOW SHALE LUDLOWVILLE SHALE SKANEATELES SHALE MARCELLUS SHALE	
MIDDLE OR LOWER DEVONIAN	Don		ONONDAGA LIMESTONE	
LOWER DEVONIAN	Do		ORISKANY SANDSTONE	
SILURIAN (UPPER)	Sm		MANLIUS AND RONDOUT LIMESTONES AND COBLESKILL DOLOMITE	SILURIAN
	Ss		SALINA FORMATION INCLUDING BERTIE LIMESTONE MEMBER AND CAMILLUSSHALE MEMBER	

SCALE

SOURCE: MODIFIED FROM-THE GROUND WATER RESOURCES
OF SENECA COUNTY, NEW YORK: MOZOLA, A.J.,
BULLETIN GW-26, ALBANY, NY, 1951

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SEAD-16 and SEAD-17

DEPT	DWG NO
ENVIRONMENTAL ENGINEERING	729895-01001

FIGURE 1-6

REGIONAL GEOLOGIC
CROSS SECTIONS

SCALE	DATE
VARIABLE	NOVEMBER 1996

R:\GRAPHICS\SENECA\GEOXSEC.CDR(CVM)

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SEAD-16 AND SEAD-17

DEPT. ENVIRONMENTAL ENGINEERING
DWG NO. 729895-01001

FIGURE 1-7

BEDROCK STRATIGRAPHIC COLUMN

SCALE
DATE NOVEMBER 1996

MESOZOIC

Lower Cretaceous

MESOZOIC INTRUSIVES

Kimberlite and alnoite dikes and dietremes

PALEOZOIC

Upper Devonian

CONNEAUT GROUP
600-1000 ft. (180-300 m.)

Germania Formation-shale, sandstone; Whiteville Formation-shale, sandstone; Hinsdale Sandstone; Wellsville Formation-shale, sandstone; Cuba Sandstona.

CANADAWAY GROUP
800-1200 FT(240-370) m.)

Machias Formation-shale, siltsone; Rushford Sandstone; Caneadea, Canistao, and Hume Shales; Canaseraga Sandstone; Stone Wales and Dunkirk Shales; in Pennsylvania: Towanda Foramtion-shale, sandstone,

JAVA GROUP
300-700 FT (90-210 m.)

Wiscoy Formation-sandstone, shale; Hanover and pipe creek shalea.

WEST FALLS GROUP
1100-1600 ft. (340-490 m.)

Nunda Formation-sandstone, shale.
West Hill and fardeau Formations-shale, siltstone; Rong Glen Shale; upper Beers Hill Shale; Grimes Siltstone.
lower Beers Hill Shale; Dunn Hill, Millport, and Moreland Shales.
Nunda Formation-sandstone, shala; West Hill Formation-shale, siltstone; Corning Shale.
"New Milford" Formation-sandstone, shale.
Gardeau formation-shale, siltstone; Roricka Galn Shale.
Slide Mountain Formation-sandstone, shale, conglomarate.
Beers Hill Shala; Grimes Siltstone; Dunn Hill, Millport, and Moreland Shales

SONYEA GROUP
200-1000 ft. (60-300 m.)

In wast: Cashaqua and Middlesex Shales.
In east: Rye Point shale; Rock Stream ("Enfield") Siltstone; Pulteney, Sawmill Creek, John Creek, and Montour Shales.

GENESEE GROUP AND TULLY LIMESTONE
200-1000 ft. (60-300 m.)

West River Shale; Genundewa Limestone; Penn Yan and Geneseo Shales; all excapt Geneseo replaced eastwardly by Ithaca Formation-shale, siltstone and Sherburne Siltstone.

Middle Devonian

Oneonta Formation-shale, sandstone.
Unadilla Formation-shale, siltstone.
Tully Limestone.

HAMILTON GROUP
600-1500 ft. (180-460 m.)

Moscow Foramtion-In west: Windom and Kashong Shales, Menteth Limestone Members; In east: Cooperstown Shale Member, Portland Point Limstone Member.
Ludlowville Formation-In west: Deep Run Shale Tichenor Limestone, Wanakah and Ledyard Shale Members, Centerfield Limestone Member. In east: King Ferry Shale and other members, Stone Mill Sandstone Member.
Skanaateles Formation-In west: Levanna shale and Stafford Limestone Members; In east: Butternut, Pompey, and Delphi Station Shale Members, Mottville Sandstone Mamber.
Marcellus Fornation-In west: Oakta Creek Shale Member; In east: Cardiff and Chittenango Shale Members, Cherry Valley Linestona and Union Springs Shale Members.
Panther Mountain Formation-shale, siltstone, sandstone.

ONONDAGA LIMESTONE AND ORISKANY SANDSTONE
75-150 ft. (23-45 m.)

Lower Devonian

Onondaga Limestone-Senaca, Morehouse (cherty) and Nedrow Limestone Members, Edgecliff cherty Limestone Member, local bioherms.
Oriskany Sandstone.

HELDERBERG GROUP
0-200 ft. (0-60 m.)

Coeymans and Manlius Limestones; Rondout Dolostone.

Upper Silurian

AKRON DOLOSTONE, COBLESKILL LIMESTONE, AND SALINA GROUP
700-1000 FT. (210-200 M.)

Akron Dolostone; Bertie Formation-dolostone , shale.
Camillus and Syracuse Formatons-shale, dolostone, gypsum, salt.
Cobleskill Limestone; Bertie and camillus Formations-dolostone, shale.
Syracusa Formation-dolostone, shale, gypsum, salt.
Vernon Formation-shala, dolostone.

LOCKPORT GROUP
80-175 FT (25-55 m.)

Oak Orchard and Penfield Dolostones, both replaced eastwardly by Sconondoa Formation-limestone, dolostone.

CLINTON GROUP
150-325 FT (40-100 m.)

Lower Silurian

Decaw Dolostona; Rochester Shala.
Irondequoit Limestone; Williamson Shale; Wolcott Furnace Hematita; Wolcott Limestone; Sodus Shale; Bear Creek Shale; Wallington Limestone; Furnaceville Hematita; Maplewood shale; Kodak Sandstone.
Herkimer Sandstone; Kirkland Hematite; Willowvale Shale; Westmoreland Hematite; Sauquoir Formation-sandstone shale; Oneida Conglomerate.

MEDINA GROUP AND QUEENSTON FORMATION
0-900 FT. (0-270 m.)

Medina Group: Grimb

Upper Ordovician

sy Formation-sandstone, shale.
Queenston Formation-shale, siltstone.
Undifferentiated Medina Group and Queenston Formation.

LORRAINE GROUP
700-900 FT. (210-270 m.)

Oswega Sandstone.
Pulaski and Whetstone Gulf Formations-siltstoen, shale.

Middle Ordovician

TRENTON GROUP
100-300 ft. (30-90 m.)

Utica Shale.

Hamilton group

MOSCOW SHALE	140±	Lower two-thirds of section is a fossiliferous, soft gray calcareous shale; upper third highly friable but leas calcareous and fossiliferous. Staining by iron oxide very common. Concretions present I greater abundance in lower beds, but irregular calcareous masses occur throughout section. Joints parallel, tightly sealed, trending N. 65° E. and N. 25° -30° W.
LUDLOWVILLE SHALE	140±	Lower beds are thinly laminated, light-colored, fossiliferous, shaly passage beds; overlain by hard calcareous black shales 5 to 12 inches thick and rich in corals and brachiopods; hard layers responsible for falls and cascades. Middle beds are less fossiliferous, soft gray arenaceous shales, rich in concretions, calcareous lenses, and occasional thin sandstone layers. Upper beds (Tichenor limestone member) are thin, irregularly bedded ray shales becoming light blue gray upon exposure, calcareous, coarsely textured, and fossiliferous. Joint parallel, 2 to 20 inches apart, well developed but tight.
SKANEATELES SHALE	185±	Basal beds composed of dark fissile shale. Upper shale more calcareous, grayish to bluish impure limestone layers. joint pattern N. 75° E. and N. 30° W.; diagonal joints N. 50° E. Joints sealed, parallel and spaced 6 inches to 4 feet apart.
MARCELLUS SHALE	50	Black, slatelike, bituminous shale with occasional limestone layers in sequence, containing zones rich in iron sulfides or calcareous conretions, often with septarian structures; very fissile, iron-stained and gray when weathered. Joint pattern N. 25° W., N. 65° E., 1 inch to 4 feet apart.

SOURCE:MODIFIED FROM-THE GROUND WATER RESOURCES OF SENECA COUNTY, NEW YORK: MOZOLA, A.J., BULLETIN GW-26, ALBANY, NY, 1951

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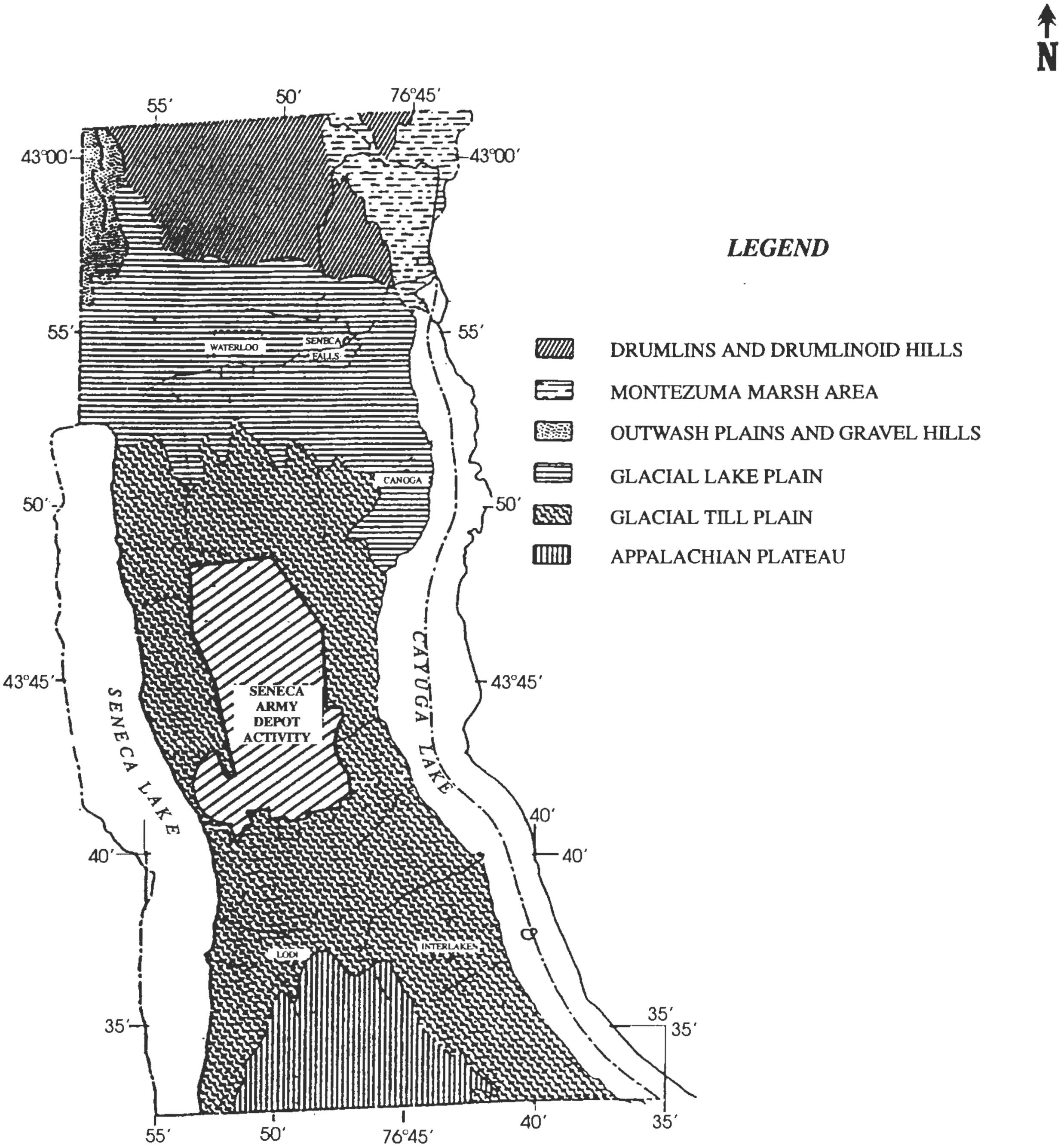

SOURCE:MODIFIED FROM-THE GROUND WATER RESOURCES OF SENECA COUNTY, NEW YORK: MOZOLA, A.J., BULLETIN GW-26, ALBANY, NY, 1951

PARSONS

PARSONS ENGINEERING SCIENCE, INC.

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT ACTIVITY

RI/FS

SEAD-16 and SEAD-17

DEPT.	DWG NO.
ENVIRONMENTAL ENGINEERING	729895-01001

FIGURE 1-8

PHYSIOGRAPHIC MAP OF SENECA COUNTY

SCALE	DATE
1" = 5 MILES	NOVEMBER 1996

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Seneca Falls. Farther north still is an area of drumlin and drumlinoid hills, which is flanked on the east by the marsh areas of the Montezuma National Wildlife Refuge and on the west by outwash plains and gravel hills (Figure 1-8).

Regional background elemental concentrations for soils from the Finger Lakes region of New York State are not available. However, background elemental concentrations for soils from the eastern United States, and in particular New York State, are available in the literature. Table 1-1 presents data for soils in the eastern United States from a United States Geological Survey (USGS) professional paper (Shacklette and Boerngen, 1984) and data for the New York State soils from a New York State Department of Environmental Conservation (NYSDEC) report by McGovern (undated).

According to the General Soils Map, Seneca County, New York (Hutton, 1972), the soils in the vicinity of SEDA are from the Darien-Anglo association, which is characterized by deep and moderately deep, somewhat poorly-drained soils that have a silty clay loam and clay loam subsoil (Figure 1-9).

1.5.2 Geology at SEDA

Previous subsurface investigations conducted at 27 separate sites at SEDA have provided important information used to develop more detailed descriptions of the till and shale at SEDA. Generally, the geology at SEDA is characterized by a thin mantle of till overlying gray Devonian shale, with a thin weathered shale zone at the contact between these two units. This stratigraphy is consistent over the entire SEDA facility.

The predominant surficial geologic unit present at the site is dense till. The till is distributed across the entire Depot and generally ranges in thickness from 3 feet to approximately 15 feet, although it is generally between 6 and 10 feet thick; at a few locations the thickness of the till is greater than 30 feet. The till is generally characterized as brown to olive-gray silt and clay, with little fine sand and variable amounts of fine to coarse gravel-sized inclusions of dark gray shale. Larger diameter clasts of shale (as large as 6 inches in diameter) are sometimes present in the basal portion of the till and are probably rip-up clasts removed from the weathered shale zone and incorporated into the till by the once-active glacier. Grain size analyses of the till show a wide distribution of particle sizes within the till (Hutton, 1972 and Metcalf & Eddy, 1989), however, there is a high percentage of silt and clay with the balance comprised of coarser particles. The porosities of 5 gray-brown silt clay (i.e., till) samples ranged from 34.0 percent to 44.2 percent with an average of 37.3 percent (USAEHA, 1985).

Darien silt-loam soils, 0 to 18 inches thick, have developed over the Wisconsin age till at both SEAD-16 and SEAD-17 (Figures 1-10 and 1-11, respectively). Figure 1-12 provides a legend for both maps. These soils are poorly drained and have a silt clay loam and a clay subsoil. In general, the topographic relief associated with these soils is 3 to 8 percent.

As part of the CERCLA investigations being conducted at SEDA, a total of 57 background soil samples have been collected from the till to provide a background data set for inorganic constituents in SEDA soils. The 57 samples were collected from 14 separate sites and are presented in Table 1-2. The minimum, maximum, average, standard deviation and the 95th upper confidence level (UCL) of the mean for background concentrations of inorganic constituents in the soil at SEDA are also shown in Table 1-2. In addition to the statistical summary information, the actual data from the individual sample points are also presented. For the statistical calculations, non-detect values have been adjusted to one-half the detection limit.

The Moscow shale (a member of the Hamilton group) is soft, gray, and fissile. This shale is extensively jointed and weathered at the contact with the overlying till. Joint spacings are from 1 inch to 4 feet based upon surface exposures. Three prominent joint directions are evident in the shale (N 60° E, N 30° W, and N 20° E) with the joint dips being primarily vertical (Mozola, 1951). Merrin (1992) also cites three prominent vertical joint directions of northeast, north-northwest, and east-northeast in outcrops of the Genesse Formation 15 miles southeast of SEDA near Ithaca, New York. Cores performed in the upper 5 to 8 feet of the bedrock at SEDA revealed low Rock Quality Designations (RQDs), i.e., less than 5 percent with almost 100 percent recovery suggesting a high degree of weathering in this upper zone (Parsons ES, 1994b; Metcalf & Eddy, 1989). Below this depth the shale is significantly less fractured.

1.5.3 Regional Hydrogeologic Setting

Regionally, four distinct hydrologic units have been identified within Seneca County (Mozola, 1951). These include two distinct shale formations, a series of limestone units, and unconsolidated

Table 1-1

Background Concentrations of Elements in Soils of the Eastern United States with Specific Data for New York State

SEAD-16 and SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Element	Concentration Range (mg/kg)	Geographic Location
Aluminum	7,000 - 100,000	Eastern U.S. (2)
	1,000 - 25,000	Albany Area (1)
Arsenic	< 0.1 - 73	Eastern U.S. (2)
	3 - 12	New York State (1)
	< 0.1 - 6.5	Albany Area (1)
Barium	10 - 1,500	Eastern U.S. (2)
	15 - 600	New York State (1)
	250 -350	Albany Area (1)
Beryllium	1 - 7	Eastern U.S. (2)
	0 - 1.75	New York State (1)
	0 - 0.9	Albany Area (1)
Cadmium	Not Available	Eastern U.S. (2)
	0.0001 - 1.0	No Region Specified (1)
Calcium	100 - 280,000	Eastern U.S. (2)
	130 - 35,000	New York State (1)
	150 - 5,000	Albany Area (1)
	2,900 - 6,500	Albany Area (1)
Chromium	1 - 1,000	Eastern U.S. (2)
	1.5 - 40	New York State (1)
	1.5 - 25	Albany Area (1)
Cobalt	< 0.3 - 70	Eastern U.S. (2)
	2.5 - 60	New York State (1)
	2.5 - 6	Albany Area (1)
Copper	< 1 - 700	Eastern U.S. (2)
	< 1 - 15	Albany Area (1)
Iron	100 - 100,000	Eastern U.S. (2)
	17,000 - 25,000	Albany Area (1)
Lead	> 10 - 300	Eastern U.S. (2)
	1 - 12.5	Albany Area (1)

Table 1-1

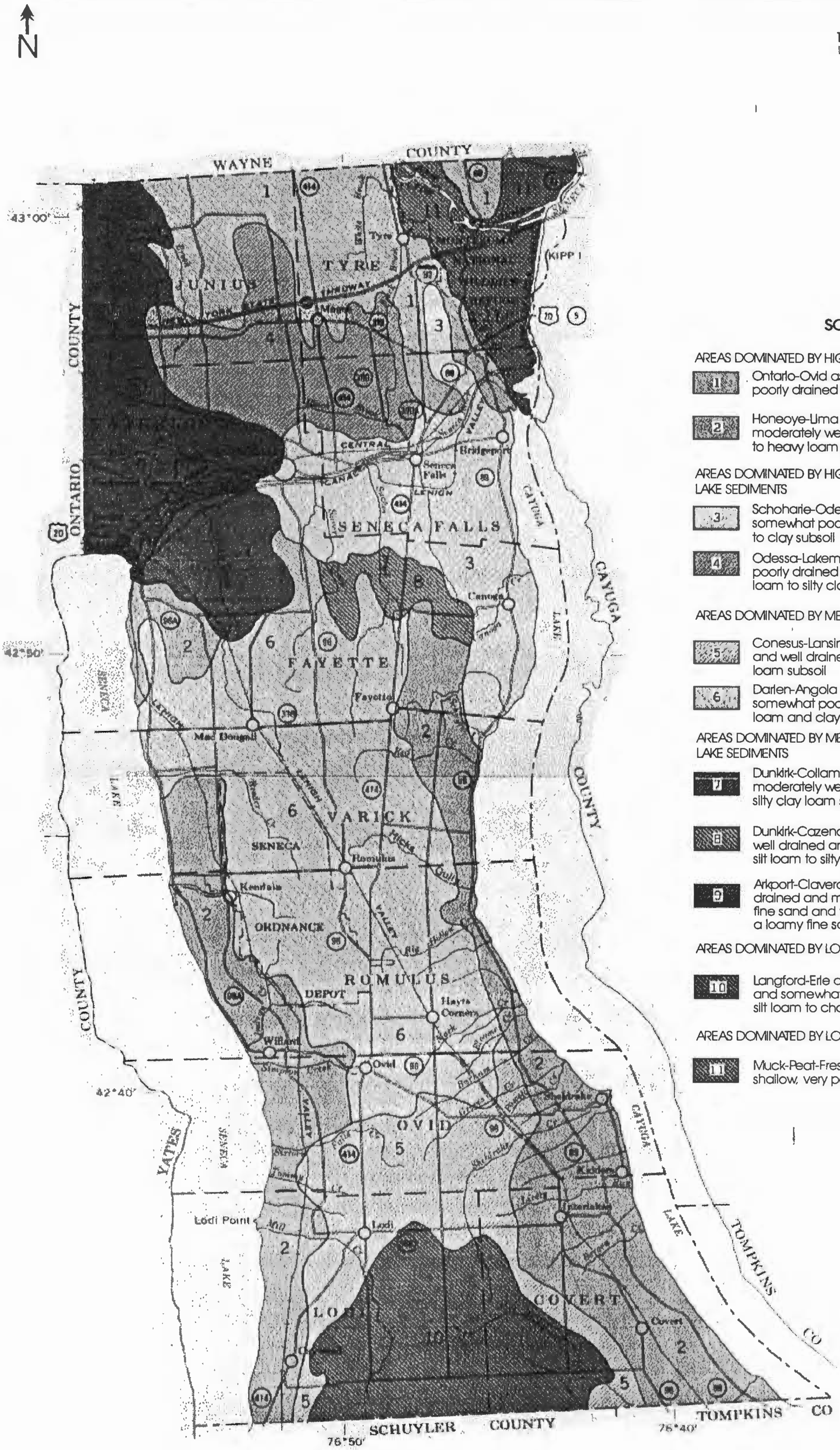
Background Concentrations of Elements in Soils of the Eastern United States with Specific Data for New York State

SEAD-16 and SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Element	Concentration Range (mg/kg)	Geographic Location
Magnesium	50 - 50,000 2,500 - 6,000 1,700 - 4,000	Eastern U.S. (2) New York State (1) Albany Area (1)
Manganese	> 2 - 7,000 50 - 5,000 400 - 600	Eastern U.S. (2) New York State (1) Albany Area (1)
Mercury	0.01 - 3.4 0.042 - 0.066	Eastern U.S. (2) Albany Area (1)
Nickel	< 5 - 700 19.5 (mean)	Eastern U.S. (2) New York State (1) (no range available)
Potassium	50 - 37,000 47.5 - 117.5	Eastern U.S. (2) New York State (1)
Selenium	> 0.1 - 3.9 Not Available	Eastern U.S. (2)
Sodium	500 - 50,000 Not Available	Eastern U.S. (2)
Vanadium	> 7 - 300 Not Available	Eastern U.S. (2)
Zinc	> 5 - 2,900 37 - 60	Eastern U.S. (2) Albany Area (1)

Notes:

1. (1) Source: McGovern, Carol E., Background Concentrations of 20 Elements in Soils with Special Regard for New York State, Wildlife Resources Center, New York Department of Environmental Conservation, Delmar, New York 12054, No Date.
2. (2) Source: Shacklette, H.T. and Boerngen, J.G., 1984, Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States, U.S.G.S. Prof Paper 1270, Washington.
3. The data are for areas where surficial materials are thought to be uncontaminated, undisturbed, or areas far from pollution sources.



1 0 1 2 3 4

SCALE IN MILES

1:190,080

SOIL ASSOCIATIONS

AREAS DOMINATED BY HIGH-LIME SOILS DEVELOPED IN GLACIAL TILL

1	Ontario-Ovid association: Deep, well-drained to somewhat poorly drained soils that have a loam to silty clay loam subsoil
2	Honeoye-Lima association: Deep, well-drained and moderately well drained soils that have a heavy silt loam to heavy loam subsoil

AREAS DOMINATED BY HIGH-LIME SOILS DEVELOPED IN GLACIAL LAKE SEDIMENTS

3	Schoharie-Odessa association: Deep, well-drained to somewhat poorly drained soils that have a silty clay loam to clay subsoil
4	Odessa-Lakemont association: Deep, dominantly somewhat poorly drained and poorly drained soils that have a silty clay loam to silty clay subsoil

AREAS DOMINATED BY MEDIUM-LIME SOILS DEVELOPED IN GLACIAL TILL

5	Conesus-Lansing association: Deep, moderately well drained and well drained soils that have a heavy silt loam to heavy loam subsoil
6	Darien-Angola association: Deep and moderately deep, somewhat poorly drained soils that have a silty clay loam and clay loam subsoil

AREAS DOMINATED BY MEDIUM-LIME SOILS DEVELOPED IN GLACIAL LAKE SEDIMENTS

7	Dunkirk-Collamer association: Deep well drained and moderately well drained soils that have a silt loam to silty clay loam subsoil
8	Dunkirk-Cazenovia association: Moderately deep and deep, well drained and moderately well drained soils that have a silt loam to silty clay loam subsoil that overlies limestone
9	Arkport-Claverack association: Deep, dominantly well drained and moderately well drained soils that are loamy fine sand and fine sandy loam throughout or that have a loamy fine sand subsoil over silty clay or clay

AREAS DOMINATED BY LOW-LIME SOILS DEVELOPED IN GLACIAL TILL

10	Langford-Erie association: Deep, moderately well drained and somewhat poorly drained soils that have a channery silt loam to channery loam fragipan

AREAS DOMINATED BY LOW-LIME SOILS DEVELOPED IN ORGANIC MATERIAL

11	Muck-Peat-Fresh Water Marsh association: Deep to shallow, very poorly drained organic soils

FEBRUARY 1971

SOURCE: U.S. DEPARTMENT OF ARGRICULTURE
SOIL CONSERVATION SERVICE
CORNELL UNIVERSITY AGRICULTURAL EXPERIMENT STATION

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CLIENT/PROJECT TITLE
SENECA ARMY DEPOT ACTIVITY
RI/FS
SEAD-16 and SEAD-17

DEPT. ENVIRONMENTAL ENGINEERING
DWG NO. 729895-01001

FIGURE 1-9

GENERAL SOIL MAP
SENECA COUNTY, NEW YORK

SCALE 1" = 2000'
DATE NOVEMBER 1996

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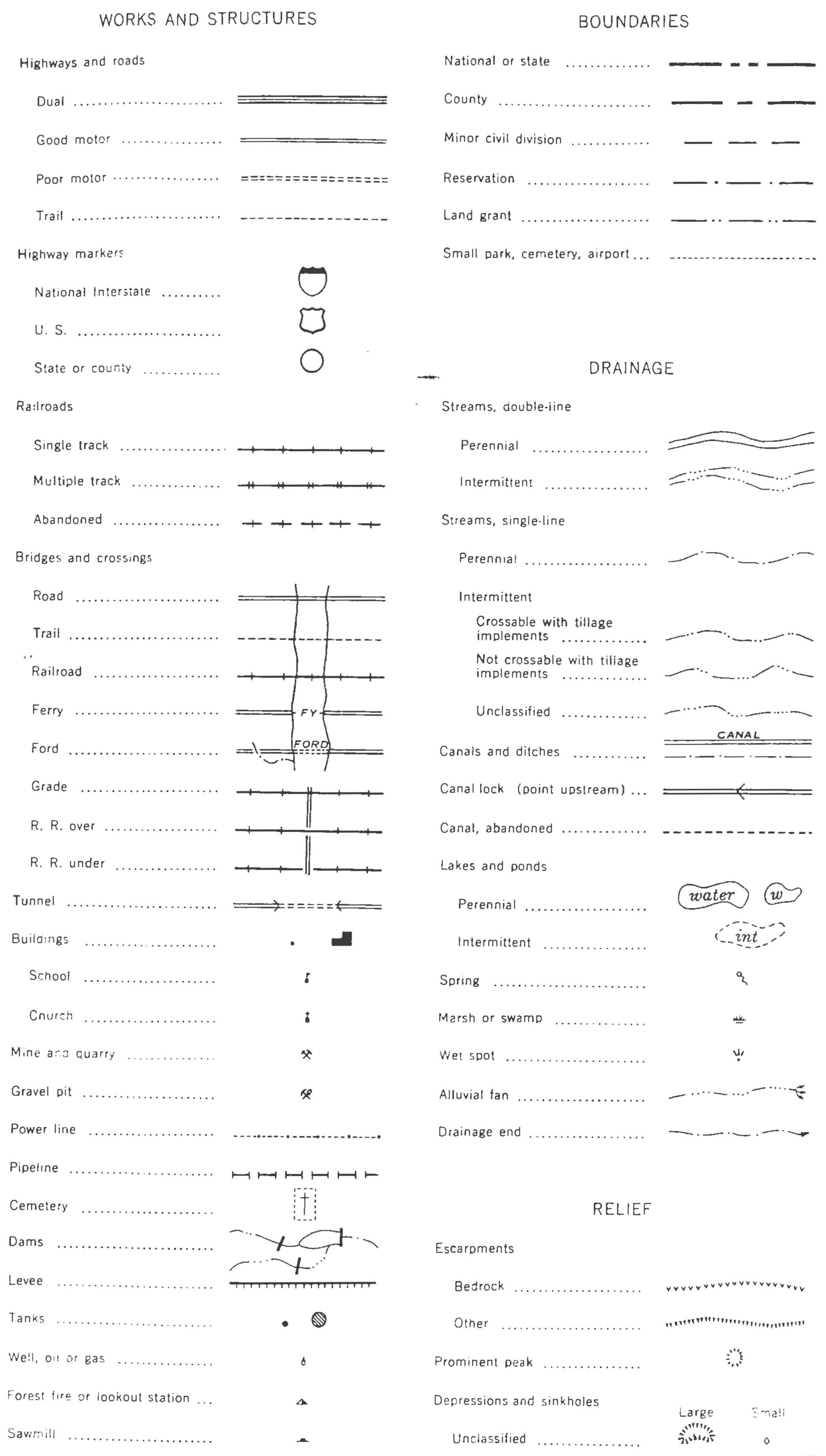
SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, E, or F, is a general guide to the slope class. Symbols without a slope letter are for those miscellaneous land types or soils where slope is not significant to use and management. A final number, 3, in the symbol shows that the soil is eroded.

SYMBOL	NAME
Ac	Alden mucky silt loam
Ad	Alden mucky silt loam, till substratum
Al	Alluvial land
AnA	Angola silt loam, 0 to 3 percent slopes
AnB	Angola silt loam, 3 to 8 percent slopes
AoA	Appleton gravelly silt loam, 0 to 3 percent slopes
AoB	Appleton gravelly silt loam, 3 to 8 percent slopes
ApA	Appleton silt loam, 0 to 3 percent slopes
ApB	Appleton silt loam, 3 to 8 percent slopes
ArB	Arkport loamy fine sand, 1 to 6 percent slopes
ArC	Arkport loamy fine sand, 6 to 12 percent slopes
ArD	Arkport loamy fine sand, 12 to 20 percent slopes
AuD	Arnot channery silt loam, 15 to 25 percent slopes
AwB	Aurora silt loam, 3 to 8 percent slopes
AwC	Aurora silt loam, 8 to 15 percent slopes
AwD	Aurora silt loam, 15 to 25 percent slopes
AzF	Aurora and Farmington soils, 25 to 75 percent slopes
Ca	Canandaigua silt loam
CeB	Cazenovia silt loam, 3 to 8 percent slopes
CeB3	Cazenovia silt loam, 3 to 8 percent slopes, eroded
CeC	Cazenovia silt loam, 8 to 15 percent slopes
CeC3	Cazenovia silt loam, 8 to 15 percent slopes, eroded
ChD	Cazenovia soils, 15 to 25 percent slopes
ChE	Cazenovia soils, 25 to 40 percent slopes
CkA	Claverack loamy fine sand, 0 to 2 percent slopes
CkB	Claverack loamy fine sand, 2 to 6 percent slopes
ClA	Collamer silt loam, 0 to 2 percent slopes
ClB	Collamer silt loam, 2 to 6 percent slopes
ClC	Collamer silt loam, 6 to 12 percent slopes
CoA	Collamer silt loam, moderately shallow variant, 0 to 2 percent slopes
CoB	Collamer silt loam, moderately shallow variant, 2 to 6 percent slopes
CsA	Conesus gravelly silt loam, 0 to 3 percent slopes
CsB	Conesus gravelly silt loam, 3 to 8 percent slopes
[illegible]	Cosad loamy fine sand
DaA	Darien silt loam, 0 to 3 percent slopes
DdB	Darien-Danley-Cazenovia silt loams, 3 to 8 percent slopes
DuB	Dunkirk silt loam, 1 to 6 percent slopes
DuC3	Dunkirk silt loam, 6 to 12 percent slopes, eroded
DuD	Dunkirk silt loam, 12 to 20 percent slopes
DwB	Dunkirk silt loam, limestone substratum, 1 to 6 percent slopes
Eb	Edwards muck
Ee	Eel silt loam
ElA	Elnora loamy fine sand, 0 to 2 percent slopes
ElB	Elnora loamy fine sand, 2 to 6 percent slopes
ErA	Erie channery silt loam, 0 to 3 percent slopes
ErB	Erie channery silt loam, 3 to 8 percent slopes
EsA	Erie channery silt loam, moderately shallow variant, 0 to 3 percent slopes
EsB	Erie channery silt loam, moderately shallow variant, 3 to 8 percent slopes
Fn	Fonda mucky silty clay loam
Fw	Fresh water marsh
HnB	Honeoye silt loam, 2 to 8 percent slopes
HnC	Honeoye silt loam, 8 to 15 percent slopes
HnD	Honeoye silt loam, 15 to 25 percent slopes
HoE	Honeoye, Ontario, and Lansing soils, 25 to 40 percent slopes
HwA	Howard gravelly loam, 0 to 5 percent slopes
HwC	Howard gravelly loam, 5 to 15 percent slopes

SYMBOL	NAME
Is	Ilion silty clay loam
LcA	Lakemont silty clay loam, 0 to 2 percent slopes
LcB	Lakemont silty clay loam, 2 to 6 percent slopes
Lf	Lamson fine sandy loam and mucky fine sandy loam
LgB	Langford channery silt loam, 2 to 8 percent slopes
LgC	Langford channery silt loam, 8 to 15 percent slopes
LgC3	Langford channery silt loam, 8 to 15 percent slopes, eroded
LgD	Langford channery silt loam, 15 to 25 percent slopes
LnB	Langford channery silt loam, moderately shallow variant, 2 to 8 percent slopes
LnC	Langford channery silt loam, moderately shallow variant, 8 to 15 percent slopes
LsB	Lansing gravelly silt loam, 2 to 8 percent slopes
LsC	Lansing gravelly silt loam, 8 to 15 percent slopes
LsC3	Lansing gravelly silt loam, 8 to 15 percent slopes, eroded
LsD	Lansing gravelly silt loam, 15 to 25 percent slopes
LtA	Lima silt loam, 0 to 3 percent slopes
LtB	Lima silt loam, 3 to 8 percent slopes
Ly	Lyons silt loam
Ma	Madalin and Odessa silty clay loams
Md	Made land, tillable
Mr	Muck, deep
Ms	Muck, shallow
Ng	Niagara silt loam
OdA	Odessa silt loam, 0 to 2 percent slopes
OdB	Odessa silt loam, 2 to 6 percent slopes
OfB	Ontario fine sandy loam, 2 to 8 percent slopes
OfC3	Ontario fine sandy loam, 8 to 15 percent slopes, eroded
OnB	Ontario loam, 2 to 8 percent slopes
OnC	Ontario loam, 8 to 15 percent slopes
OnC3	Ontario loam, 8 to 15 percent slopes, eroded
OnD3	Ontario loam, 15 to 25 percent slopes, eroded
OpB	Ontario silt loam, moderately shallow variant, and Farmington soils, 2 to 8 percent slopes
OvA	Ovid silt loam, 0 to 3 percent slopes
OvB	Ovid silt loam, 3 to 8 percent slopes
PgA	Palmyra gravelly loam, 0 to 5 percent slopes
PgC	Palmyra gravelly loam, 5 to 15 percent slopes
PhD	Palmyra and Howard soils, 15 to 25 percent slopes
PhE	Palmyra and Howard soils, 25 to 35 percent slopes
Ro	Romulus silty clay loam
SeB	Schoharie silt loam, 2 to 6 percent slopes
ShA	Schoharie silty clay loam, 0 to 2 percent slopes
ShB	Schoharie silty clay loam, 2 to 6 percent slopes
SnC3	Schoharie silty clay loam, 6 to 12 percent slopes, eroded
ShD3	Schoharie silty clay loam, 12 to 20 percent slopes, eroded
Sn	Sloan silt loam
Sr	Stafford loamy fine sand
Vc	Varick silty clay loam
Wk	Wallkill soils

CONVENTIONAL SIGNS



WORKS AND STRUCTURES

Highways and roads
- Dual
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry
- Ford
- Grade
- R. R. over
- R. R. under

Tunnel

Buildings

School

Church

Mine and quarry

Gravel pit

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Well, oil or gas

Forest fire or lookout station

Sawmill

BOUNDARIES

National or state

County

Minor civil division

Reservation

Land grant

Small park, cemetery, airport

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
  - Unclassified

Canals and ditches

Canal lock (point upstream)

Canal, abandoned

Lakes and ponds
- Perennial
- Intermittent

Spring

Marsh or swamp

Wet spot

Alluvial fan

Drainage end

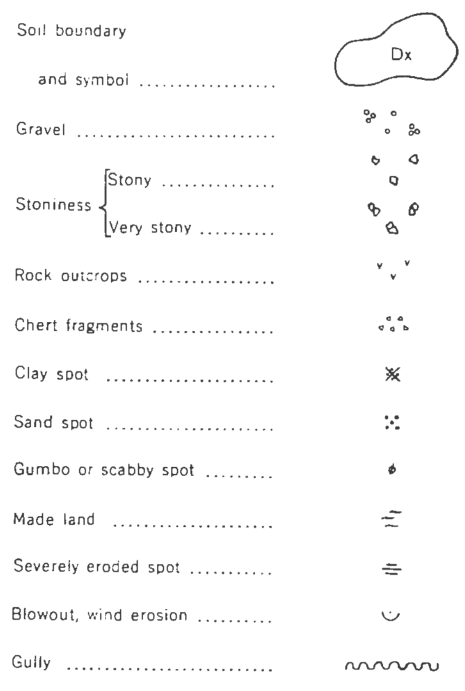
RELIEF

Escarpments
- Bedrock
- Other

Prominent peak

Depressions and sinkholes
- Unclassified

SOIL SURVEY DATA



Soil boundary and symbol

Gravel

Stoniness
- Stony
- Very stony

Rock outcrops

Chert fragments

Clay spot

Sand spot

Gumbo or scabby spot

Made land

Severely eroded spot

Blowout, wind erosion

Gully

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CLIENT/PROJECT TITLE

SENECA ARMY DEPOT ACTIVITY
RI/FS
SEAD-16 AND SEAD-17

DEPT. ENVIRONMENTAL ENGINEERING

DWG NO. 729895-01001

FIGURE 1-12

SURFICIAL SOIL MAP LEGEND

SCALE

DATE NOVEMBER 1996

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Table 1-2

Statistical Comparison o Background Concentrations
of Metals (mg/Kg) in Soils at SEDA

SEAD-16 and SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Total Samples: 53

Compound	Minimum Soils	Maximum Soils	Average Soils	Standard Deviation	95th Upper Confidence Limit (4)	ASH B8-91 0-2 ft	ASH B8-91 2-4 ft	ASH B8-91 2-4 ft	ASH B8-91 6-8 ft	ASH B9-91 0-2 ft	ASH B9-91 2-4 ft	ASH B9-91 6-8 ft	ASH BK-1 0-2 ft
Compound	Minimum Soils	Maximum Soils	Average Soils	Standard Deviation	95th Upper Confidence Limit (4)	ASH B8-91 0-2 ft	ASH B8-91 2-4 ft	ASH B8-91 2-4 ft	ASH B8-91 6-8 ft	ASH B9-91 0-2 ft	ASH B9-91 2-4 ft	ASH B9-91 6-8 ft	ASH BK-1 0-2 ft
Aluminum	5560.00	21200	13736.73	4490.13	14732.69	19200	20500	17700	12700	14800	8880	7160	19400
Antimony	0.08	6.8	2.64	2.18	3.13	5.15	4.4	4.1	4.2	4.95	4.95	3.5	3.95
Arsenic	2.70	21.5	5.55	2.80	6.19	5.1	6.1	6	4.2	4.3	3.8	4.4	3
Barium	33.90	159	81.33	27.06	87.33	136	98.9	86.7	56.2	101	110	39.9	159
Beryllium	0.27	1.4	0.68	0.25	0.73	1.4	1.2	1	0.78	1.1	0.76	0.52	1.1
Cadmium	0.01	2.9	0.59	0.73	0.91	2.6	2.9	2.4	1.9	2.3	1.7	1.5	0.225
Calcium	1370.00	293000	45158.55	48324.39	100584.67	5390	4870	3560	85900	45600	104000	101000	4590
Chromium	10.30	35.8	20.94	6.43	22.36	27.4	30.1	26.9	19.8	22.5	13.8	11.2	30
Cobalt	5.20	29.1	11.39	4.33	12.35	13.8	18.4	14	14.2	13.7	10.7	8.1	14.4
Copper	9.70	62.8	21.39	7.70	23.10	22.3	27.6	26	16.2	22.6	21.6	19.3	26.9
Iron	8770.00	42500	25221.27	7436.42	26870.76	37200	36100	32500	27400	31000	19600	17300	38600
Lead	5.40	45.5	12.93	6.69	14.64	14.5	11.4	13.6	10.1	10.8	10.1	7.8	15.8
Magnesium	2830.00	29100	10429.64	6033.43	11767.92	5850	7300	6490	6720	8860	17000	12600	5980
Manganese	207.00	2380	599.24	340.06	677.57	1130	956	832	926	903	532	514	2380
Mercury	0.01	0.5	0.05	0.07	0.06	0.09	0.06	0.06	0.05	0.08	0.04	0.05	0.13
Nickel	12.30	62.3	31.58	11.07	34.03	42.3	48.7	44.4	30.4	38.4	23.8	19	47.7
Potassium	901.00	3460	1655.29	592.74	1786.77	1910	2110	1760	1430	1320	1080	1050	1720
Selenium	0.05	2.1	0.41	0.45	0.59	0.085	0.105	0.1	0.305	0.105	0.325	0.105	0.73
Silver	0.04	0.87	0.34	0.26	0.39	0.8	0.65	0.6	0.65	0.75	0.75	0.55	0.235
Sodium	8.45	269	90.12	54.38	102.18	39.6	33.75	31.3	75.3	84.2	112	116	49.1
Thallium	0.08	0.75	0.23	0.15	0.26	0.235	0.29	0.285	0.17	0.295	0.18	0.3	0.21
Vanadium	11.50	35.8	22.16	6.67	23.64	32.2	25.4	26.4	15.7	19.7	19.5	12.9	28
Zinc	36.20	126	73.07	20.52	77.75	85.1	94.2	85	75	126	84.3	74.8	98.6
Cyanide	0.22	0.41	0.29	0.04	0.30	0.3	0.315	0.335	0.29	0.35	0.315	0.31	0.285

Notes:

1) This table presents chemical analysis results from subsurface soil samples taken across SEDA.

2) For statistical calculations, all detects (no qualifier or J qualifier) were taken at full value, and all non-detects (U or UJ qualifier) were taken at half value.

3) The samples are from: Ash Landfill, OB Grounds, SEAD-4, SEAD-11, SEAD-12, SEAD-13, SEAD-16, SEAD-17, SEAD-24, SEAD-25, SEAD-26, SEAD-64, SEAD-67, and SEAD-70

4) The "H" statistic was used to calculate the 95th UCL of lognormally distributed data

5) "R" qualifier indicates data were rejected during data validation.

6) "NA" indicates that chemical analysis results for the compound were not determined.

Background data from 10 and 15 SWMU investigations are in this table

Table 1-2

Statistical Comparison o Background Concentrations of Metals (mg/Kg) in Soils at SEDA

SEAD-16 and SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Total Samples: 53

Compound	Minimum Soils	Maximum Soils	Average Soils	Standard Deviation	95th Upper Confidence Limit (4)	ASH BK-2 0-2 ft	OB MW-34 0-2 ft	OB GB35-1 0-2 ft	OB GB35-2 2-4 ft	OB GB35-6 0-2 ft	OB GB36-1 0-2 ft	OB GB36-2 2-4 ft	SEAD-4 SB4-1.1 0-2 ft
Compound	Minimum Soils	Maximum Soils	Average Soils	Standard Deviation	95th Upper Confidence Limit (4)	ASH BK-2 0-2 ft	OB MW-34 0-2 ft	OB GB35-1 0-2 ft	OB GB35-2 2-4 ft	OB GB35-6 0-2 ft	OB GB36-1 0-2 ft	OB GB36-2 2-4 ft	SEAD-4 SB4-1.1 0-2 ft
Aluminum	5560.00	21200	13736.73	4490.13	14732.69	14400	16100	18000	17600	16200	18100	16200	14800
Antimony	0.08	6.8	2.64	2.18	3.13	3.6	5.7	2.9	6.8	6.3	5.9	2.9	2.4
Arsenic	2.70	21.5	5.55	2.80	6.19	2.7	3.15	6.2	7.7	5.3	4.6	9.7	6.2
Barium	33.90	159	81.33	27.06	87.33	106	67.5	93.6	61.7	61.7	74.8	50.8	72
Beryllium	0.27	1.4	0.68	0.25	0.73	0.81	0.86	0.85	0.74	0.77	0.77	0.65	0.73
Cadmium	0.01	2.9	0.59	0.73	0.91	0.205	2.3	0.165	0.155	0.175	0.15	0.165	0.235
Calcium	1370.00	293000	45158.55	48324.39	100584.67	22500	28600	1590	17700	1370	1660	22900	4280
Chromium	10.30	35.8	20.94	6.43	22.36	22.3	26.6	23.5	29.3	25.1	24.8	27.4	23.2
Cobalt	5.20	29.1	11.39	4.33	12.35	12.3	17	9.4	16.3	10.3	20.4	13.2	11.3
Copper	9.70	62.8	21.39	7.70	23.10	18.8	32.7	17.5	24.5	17.2	17.7	17.5	14.1
Iron	8770.00	42500	25221.27	7436.42	26870.76	26600	35000	25200	34200	30800	26100	30700	27500
Lead	5.40	45.5	12.93	6.69	14.64	18.9	11.9	14.4	5.4	19.1	12.7	6.2	17.7
Magnesium	2830.00	29100	10429.64	6033.43	11767.92	7910	6850	3850	7790	4490	4490	7150	4270
Manganese	207.00	2380	599.24	340.06	677.57	800	803	701	646	775	426	507	R (5)
Mercury	0.01	0.5	0.05	0.07	0.06	0.11	R (5)	0.06	0.015	0.07	0.02	0.02	0.05
Nickel	12.30	62.3	31.58	11.07	34.03	31	49.3	26.3	48.7	28.3	28.3	42.8	27.8
Potassium	901.00	3460	1655.29	592.74	1786.77	1210	1290	1110	1110	975	1400	1100	1250
Selenium	0.05	2.1	0.41	0.45	0.59	0.94	0.09	0.115	0.115	0.105	0.1	0.09	0.4
Silver	0.04	0.87	0.34	0.26	0.39	0.215	0.87	0.17	0.16	0.18	0.155	0.17	0.465
Sodium	8.45	269	90.12	54.38	102.18	61.1	55.2	35.6	77.5	34.6	46.6	97.6	21.9
Thallium	0.08	0.75	0.23	0.15	0.26	0.19	0.255	0.275	0.27	0.25	0.23	0.215	0.115
Vanadium	11.50	35.8	22.16	6.67	23.64	22.4	22.3	27.1	22.3	26.1	27.8	19.7	28.6
Zinc	36.20	126	73.07	20.52	77.75	63.7	95.7	55	83.4	53.1	59.2	74.1	79.6
Cyanide	0.22	0.41	0.29	0.04	0.30	0.305	0.27	0.39	0.355	0.41	0.35	0.34	0.26

Notes:

1) This table presents chemical analysis results from subsurface soil samples taken across SEDA.

2) For statistical calculations, all detects (no qualifier or J qualifier) were taken at full value, and all non-detects (U or UJ qualifier) were taken at half value.

3) The samples are from: Ash Landfill, OB Grounds, SEAD-4, SEAD-11, SEAD-12, SEAD-13, SEAD-16, SEAD-17, SEAD-24, SEAD-25, SEAD-26, SEAD-64, SEAD-67, and SEAD-70.

4) The "H" statistic was used to calculate the 95th UCL of lognormally distributed data.

5) "R" qualifier indicates data were rejected during data validation.

6) "NA" indicates that chemical analysis results for the compound were not determined.

Background data from 10 and 15 SWMU investigations are in this table

Table 1-2

Statistical Comparison o Background Concentrations of Metals (mg/Kg) in Soils at SEDA

SEAD-16 and SEAD-17 Remedial Investigation Seneca Army Depot Activity

Total Samples: 53

Compound	Minimum Soils	Maximum Soils	Average Soils	Standard Deviation	95th Upper Confidence Limit (4)	SEAD-4 SB4-1.1 0-2 ft dup.	SEAD-4 SB4-1.3 4-6 ft	SEAD-4 SB4-1.6 8-10 ft	SEAD-11 SB11-3.1 0-2 ft	SEAD-11 SB11-3.2 4-6 ft	SEAD-11 SB11-3.6 10-12 ft	SEAD-13 SB13-1.1 0-2 ft	SEAD-13 SB13-1.3 6-8 ft
Compound	Minimum Soils	Maximum Soils	Average Soils	Standard Deviation	95th Upper Confidence Limit (4)	SEAD-4 SB4-1.1 0-2 ft dup.	SEAD-4 SB4-1.3 4-6 ft	SEAD-4 SB4-1.6 8-10 ft	SEAD-11 SB11-3.1 0-2 ft	SEAD-11 SB11-3.2 4-6 ft	SEAD-11 SB11-3.6 10-12 ft	SEAD-13 SB13-1.1 0-2 ft	SEAD-13 SB13-1.3 6-8 ft
Aluminum	5560.00	21200	13736.73	4490.13	14732.69	21000	15300	19200	17600	6330	10900	18300	8250
Antimony	0.08	6.8	2.64	2.18	3.13	1.9	2.5	1.4	5.4	4	3.8	5.1	1.85
Arsenic	2.70	21.5	5.55	2.80	6.19	4.2	3.9	21.5	R (5)	R (5)	R (5)	7	6.2
Barium	33.90	159	81.33	27.06	87.33	97.7	40.4	81.2	113	57.4	62.7	106	88.1
Beryllium	0.27	1.4	0.68	0.25	0.73	0.64	0.74	1	0.85	0.34	0.47	0.92	0.42
Cadmium	0.01	2.9	0.59	0.73	0.91	0.185	0.245	0.135	0.335	0.25	0	0.225	0.18
Calcium	1370.00	293000	45158.55	48324.39	100584.67	2460	30900	14400	4950	91300	48600	3570	87700
Chromium	10.30	35.8	20.94	6.43	22.36	27.9	27.6	32.7	24	11.1	18.6	29.4	13.3
Cobalt	5.20	29.1	11.39	4.33	12.35	5.9	16.5	29.1	11.3	6.5	10.1	12	7.2
Copper	9.70	62.8	21.39	7.70	23.10	15.1	62.8	21.6	20	12.2	21.7	11.6	18.4
Iron	8770.00	42500	25221.27	7436.42	26870.76	19500	34300	37900	27200	13200	28300	32500	17400
Lead	5.40	45.5	12.93	6.69	14.64	9.8	7.5	9.1	27.9	11.4	10.1	R (5)	R (5)
Magnesium	2830.00	29100	10429.64	6033.43	11767.92	4460	7130	8040	4160	12900	10100	5890	20800
Manganese	207.00	2380	599.24	340.06	677.57	R (5)	R (5)	R (5)	674	356	434	451	517
Mercury	0.01	0.5	0.05	0.07	0.06	0.04	0.04	0.04	0.05	0.02	0.02	0.03	0.07
Nickel	12.30	62.3	31.58	11.07	34.03	25.1	47.6	62.3	28.3	16.7	29.5	34.9	24
Potassium	901.00	3460	1655.29	592.74	1786.77	2490	1300	2030	2110	1110	1230	2190	1390
Selenium	0.05	2.1	0.41	0.45	0.59	0.23	0.045	0.07	0.24	0.065	0.105	0.26	0.56
Silver	0.04	0.87	0.34	0.26	0.39	0.37	0.495	0.64	0.7	0.5	0.485	0.45	0.305
Sodium	8.45	269	90.12	54.38	102.18	39.2	105	91.6	66.3	136	146	80.6	155
Thallium	0.08	0.75	0.23	0.15	0.26	0.12	0.08	0.12	0.095	0.75	0.115	0.43	0.43
Vanadium	11.50	35.8	22.16	6.67	23.64	31	22.2	29.3	31.8	13.3	17	32.7	13.3
Zinc	36.20	126	73.07	20.52	77.75	72.1	102	115	R (5)	R (5)	R (5)	81.9	56.2
Cyanide	0.22	0.41	0.29	0.04	0.30	0.265	0.265	0.235	0.285	0.235	0.265	0.305	0.25

Notes:

1) This table presents chemical analysis results from subsurface soil samples taken across SEDA.

2) For statistical calculations, all detects (no qualifier or J qualifier) were taken at full value, and all non-detects (U or UJ qualifier) were taken at half value.

3) The samples are from: Ash Landfill, OB Grounds, SEAD-4, SEAD-11, SEAD-12, SEAD-13, SEAD-16, SEAD-17, SEAD-24, SEAD-25, SEAD-26, SEAD-64, SEAD-67, and SEAD-70.

4) The "H" statistic was used to calculate the 95th UCL of lognormally distributed data.

5) "R" qualifier indicates data were rejected during data validation.

6) "NA" indicates that chemical analysis results for the compound were not determined.

Background data from 10 and 15 SWMU investigations are in this table

Table 1-2

Statistical Comparison o Background Concentrations of Metals (mg/Kg) in Soils at SEDA

SEAD-16 and SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Total Samples: 53

Compound	Minimum Soils	Maximum Soils	Average Soils	Standard Deviation	95th Upper Confidence Limit (4)	SEAD-13 SB13-1.4 8-10 ft	SEAD-13 SB13-4.1 0-2 ft	SEAD-13 SB13-4.2 2-4 ft	SEAD-13 SB13-4.3 4-6 ft	SEAD-24 SB24-5.1 0-2 ft	SEAD-24 SB24-5.3 4-6 ft	SEAD-24 SB24-5.5 8-10 ft	SEAD-25 SB25-6.1 0-2 ft
Compound	Minimum Soils	Maximum Soils	Average Soils	Standard Deviation	95th Upper Confidence Limit (4)	SEAD-13 SB13-1.4 8-10 ft	SEAD-13 SB13-4.1 0-2 ft	SEAD-13 SB13-4.2 2-4 ft	SEAD-13 SB13-4.3 4-6 ft	SEAD-24 SB24-5.1 0-2 ft	SEAD-24 SB24-5.3 4-6 ft	SEAD-24 SB24-5.5 8-10 ft	SEAD-25 SB25-6.1 0-2 ft
Aluminum	5560.00	21200	13736.73	4490.13	14732.69	11700	21200	15500	20400	16200	10100	13700	10600
Antimony	0.08	6.8	2.64	2.18	3.13	1.4	2	4.5	1.6	6.25	2.9	5.65	2.1
Arsenic	2.70	21.5	5.55	2.80	6.19	5.7	8.1	6.8	9.6	4.2	3.3	5	8.3
Barium	33.90	159	81.33	27.06	87.33	33.9	129	96.9	79.1	117	58.3	67.2	59.1
Beryllium	0.27	1.4	0.68	0.25	0.73	0.54	1.1	0.78	1	0.98	0.48	0.65	0.48
Cadmium	0.01	2.9	0.59	0.73	0.91	0.135	0.19	0.17	0.155	0.39	0.18	0.35	R (5)
Calcium	1370.00	293000	45158.55	48324.39	100584.67	50300	28800	68000	10200	4540	74200	49000	82500
Chromium	10.30	35.8	20.94	6.43	22.36	19.6	30.2	25.8	35.8	24.5	16.9	23.1	16.9
Cobalt	5.20	29.1	11.39	4.33	12.35	11.1	10.6	12.4	12.1	16	8.2	12	11.2
Copper	9.70	62.8	21.39	7.70	23.10	17.6	21.6	21.1	26.5	28.4	20.9	22.2	20.2
Iron	8770.00	42500	25221.27	7436.42	26870.76	24700	31600	30100	42500	33600	21300	26700	21400
Lead	5.40	45.5	12.93	6.69	14.64	R (5)	13.6	13.6	7.1	45.5	8.7	7.9	9.5
Magnesium	2830.00	29100	10429.64	6033.43	11767.92	12600	8780	10600	9660	5150	12100	11400	19600
Manganese	207.00	2380	599.24	340.06	677.57	404	363	607	398	1080	400	450	722
Mercury	0.01	0.5	0.05	0.07	0.06	0.01	0.05	0.01	0.02	R (5)	R (5)	R (5)	0.03
Nickel	12.30	62.3	31.58	11.07	34.03	33.1	38.1	43.2	53	37.3	26.4	35.2	26.8
Potassium	901.00	3460	1655.29	592.74	1786.77	1270	2130	1570	1810	1170	993	1660	1480
Selenium	0.05	2.1	0.41	0.45	0.59	0.51	0.53	0.2	0.28	0.075	0.115	0.11	0.97
Silver	0.04	0.87	0.34	0.26	0.39	0.27	0.385	0.345	0.315	0.8	0.365	0.7	0.41
Sodium	8.45	269	90.12	54.38	102.18	134	81.5	183	87.8	50.9	153	139	269
Thallium	0.08	0.75	0.23	0.15	0.26	0.64	0.11	0.1	0.09	0.08	0.125	0.12	0.12
Vanadium	11.50	35.8	22.16	6.67	23.64	16.3	35.8	23.1	30.7	29.9	14.4	19.5	18.5
Zinc	36.20	126	73.07	20.52	77.75	45.3	89.4	65.8	93	85.7	62.8	63.2	71.6
Cyanide	0.22	0.41	0.29	0.04	0.30	0.265	0.27	0.255	0.27	0.3	0.255	0.285	0.29

Notes:

1) This table presents chemical analysis results from subsurface soil samples taken across SEDA.

2) For statistical calculations, all detects (no qualifier or J qualifier) were taken at full value, and all non-detects (U or UJ qualifier) were taken at half value.

3) The samples are from: Ash Landfill, OB Grounds, SEAD-4, SEAD-11, SEAD-12, SEAD-13, SEAD-16, SEAD-17, SEAD-24, SEAD-25, SEAD-26, SEAD-64, SEAD-67, and SEAD-70

4) The "H" statistic was used to calculate the 95th UCL of lognormally distributed data.

5) "R" qualifier indicates data were rejected during data validation.

6) "NA" indicates that chemical analysis results for the compound were not determined.

Background data from 10 and 15 SWMU investigations are in this table

Table 1-2

Statistical Comparison o Background Concentrations of Metals (mg/Kg) in Soils at SEDA

SEAD-16 and SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Total Samples: 53

Compound	Minimum Soils	Maximum Soils	Average Soils	Standard Deviation	95th Upper Confidence Limit (4)	SEAD-25 SB25-6.2 2-4 ft	SEAD-26 SB26-1.1 0-2 ft	SEAD-26 SB26-1.2 2-4 ft	SEAD-12 W12A-1-0 0-0.2 ft	SEAD-12 W12A-1-0 4-6 ft	SEAD-12 W12A-1-0 8-9.5 ft	SEAD-12 W12B-1-0 0-0.2 ft	SEAD-12 W12B-1-0 4-6 ft
Compound	Minimum Soils	Maximum Soils	Average Soils	Standard Deviation	95th Upper Confidence Limit (4)	SEAD-25 SB25-6.2 2-4 ft	SEAD-26 SB26-1.1 0-2 ft	SEAD-26 SB26-1.2 2-4 ft	SEAD-12 W12A-1-0 0-0.2 ft	SEAD-12 W12A-1-0 4-6 ft	SEAD-12 W12A-1-0 8-9.5 ft	SEAD-12 W12B-1-0 0-0.2 ft	SEAD-12 W12B-1-0 4-6 ft
Aluminum	5560.00	21200	13736.73	4490.13	14732.69	7070	5560	9040	18700	11000	12400	10800	8060
Antimony	0.08	6.8	2.64	2.18	3.13	1.5	3.65	3.35	0.11	0.12	0.1	0.115	0.1
Arsenic	2.70	21.5	5.55	2.80	6.19	4.8	3.2	5.3	5.2	3.5	3.6	6.6	4.6
Barium	33.90	159	81.33	27.06	87.33	35	73.2	43.7	125	82.8	78.3	102	89.1
Beryllium	0.27	1.4	0.68	0.25	0.73	0.35	0.35	0.41	0.8	0.46	0.58	0.53	0.4
Cadmium	0.01	2.9	0.59	0.73	0.91	R (5)	0.23	0.21	0.86	0.52	0.85	0.63	0.52
Calcium	1370.00	293000	45158.55	48324.39	100584.67	122000	293000	47300	3370	71200	70300	45900	79400
Chromium	10.30	35.8	20.94	6.43	22.36	11.3	10.3	15.7	23.1	15.3	19.7	16	12.7
Cobalt	5.20	29.1	11.39	4.33	12.35	6.6	5.9	9.5	10.9	10.1	10.8	9.2	8.6
Copper	9.70	62.8	21.39	7.70	23.10	12	9.7	14.3	19.1	20.6	29.6	30.4	22.5
Iron	8770.00	42500	25221.27	7436.42	26870.76	15800	8770	19100	23500	17400	22600	23400	17200
Lead	5.40	45.5	12.93	6.69	14.64	13.8	6.33	8.5	21.6	7.6	10.8	17.1	10.3
Magnesium	2830.00	29100	10429.64	6033.43	11767.92	22800	29100	9160	3880	19200	12000	11400	16300
Manganese	207.00	2380	599.24	340.06	677.57	610	309	551	939	414	409	418	388
Mercury	0.01	0.5	0.05	0.07	0.06	0.02	0.01	0.01	0.06	0.02	0.03	0.04	0.5
Nickel	12.30	62.3	31.58	11.07	34.03	18	16.3	23.9	25.7	23.7	35.5	28	23.6
Potassium	901.00	3460	1655.29	592.74	1786.77	1060	1710	901	2660	3460	2910	1870	1660
Selenium	0.05	2.1	0.41	0.45	0.59	0.63	0.065	0.26	1.2	0.25	0.205	1.3	0.72
Silver	0.04	0.87	0.34	0.26	0.39	0.295	0.46	0.425	0.045	0.045	0.04	0.045	0.04
Sodium	8.45	269	90.12	54.38	102.18	186	192	108	8.45	79.9	136	76.2	135
Thallium	0.08	0.75	0.23	0.15	0.26	0.105	0.365	0.085	0.16	0.175	0.145	0.41	0.64
Vanadium	11.50	35.8	22.16	6.67	23.64	12	12.7	14.4	33.1	21.7	20.2	20.9	13.8
Zinc	36.20	126	73.07	20.52	77.75	40.6	56	90.6	77.8	41.4	82.1	62.7	50.5
Cyanide	0.22	0.41	0.29	0.04	0.30	0.32	0.24	0.285	0.3	0.265	0.215	0.25	0.235

Notes:

1) This table presents chemical analysis results from subsurface soil samples taken across SEDA.

2) For statistical calculations, all detects (no qualifier or J qualifier) were taken at full value, and all non-detects (U or UJ qualifier) were taken at half value.

3) The samples are from: Ash Landfill, OB Grounds, SEAD-4, SEAD-11, SEAD-12, SEAD-13, SEAD-16, SEAD-17, SEAD-24, SEAD-25, SEAD-26, SEAD-64, SEAD-67, and SEAD-70.

4) The "H" statistic was used to calculate the 95th UCL of lognormally distributed data.

5) "R" qualifier indicates data were rejected during data validation.

6) "NA" indicates that chemical analysis results for the compound were not determined.

Background data from 10 and 15 SWMU investigations are in this table

Table 1-2

Statistical Comparison o Background Concentrations of Metals (mg/Kg) in Soils at SEDA

SEAD-16 and SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Total Samples: 53

Compound	Minimum Soils	Maximum Soils	Average Soils	Standard Deviation	95th Upper Confidence Limit (4)	SEAD-12 W12B-1-0 12-13.5 ft	SEAD-64 W64A-1.0 0-0.2 ft	SEAD-64 W64A-1.0 2-4 ft	SEAD-64 W64A-1.0 4-6 ft	SEAD-64 W64B-1-0 0-0.2 ft	SEAD-64 W64B-1-0 4-6 ft	SEAD-64 W64B-1-0 6-8 ft	SEAD-67 MW67-2.00 0-0.2 ft
Compound	Minimum Soils	Maximum Soils	Average Soils	Standard Deviation	95th Upper Confidence Limit (4)	SEAD-12 W12B-1-0 12-13.5 ft	SEAD-64 W64A-1.0 0-0.2 ft	SEAD-64 W64A-1.0 2-4 ft	SEAD-64 W64A-1.0 4-6 ft	SEAD-64 W64B-1-0 0-0.2 ft	SEAD-64 W64B-1-0 4-6 ft	SEAD-64 W64B-1-0 6-8 ft	SEAD-67 MW67-2.00 0-0.2 ft
Aluminum	5560.00	21200	13736.73	4490.13	14732.69	5940	16100	19800	12600	13400	8870	7620	16700
Antimony	0.08	6.8	2.64	2.18	3.13	0.13	0.23	0.1	0.1	0.3	0.075	0.075	0.27
Arsenic	2.70	21.5	5.55	2.80	6.19	2.9	7.1	8.2	5	5.5	4.3	5.5	4.4
Barium	33.90	159	81.33	27.06	87.33	43.8	83.7	91.2	62.3	75.5	70.8	76.7	114
Beryllium	0.27	1.4	0.68	0.25	0.73	0.27	0.68	0.74	0.53	0.56	0.43	0.37	0.67
Cadmium	0.01	2.9	0.59	0.73	0.91	0.32	0.11	0.01	0.12	0.63	0.64	0.54	0.2
Calcium	1370.00	293000	45158.55	48324.39	100584.67	51100	7210	4300	72400	5530	70000	75900	3580
Chromium	10.30	35.8	20.94	6.43	22.36	12	23	25	19	17.5	14.1	13.5	19.5
Cobalt	5.20	29.1	11.39	4.33	12.35	5.2	11.8	11.3	9.1	7.2	10	7.4	7.5
Copper	9.70	62.8	21.39	7.70	23.10	17.3	25.5	21	23.7	18.9	20.2	17.6	16.5
Iron	8770.00	42500	25221.27	7436.42	26870.76	13500	28500	28000	22600	20900	18400	17100	20500
Lead	5.40	45.5	12.93	6.69	14.64	7.3	21.6	13.6	15.4	21.4	8.8	8.3	17.5
Magnesium	2830.00	29100	10429.64	6033.43	11767.92	8320	5480	5010	14800	3720	18900	21500	3590
Manganese	207.00	2380	599.24	340.06	677.57	244	558	604	402	207	434	389	438
Mercury	0.01	0.5	0.05	0.07	0.06	0.03	0.05	0.03	0.02	0.05	0.02	0.005	0.04
Nickel	12.30	62.3	31.58	11.07	34.03	19	32.2	28.6	26.7	19.8	28.2	22.6	18.7
Potassium	901.00	3460	1655.29	592.74	1786.77	1040	2590	2260	2700	1700	1630	1650	1780
Selenium	0.05	2.1	0.41	0.45	0.59	2.1	0.96	1.7	0.17	0.99	0.13	0.57	0.81
Silver	0.04	0.87	0.34	0.26	0.39	0.05	0.06	0.07	0.07	0.08	0.065	0.065	0.065
Sodium	8.45	269	90.12	54.38	102.18	77.3	13.75	15.9	92.1	17.95	96.8	79.6	12.55
Thallium	0.08	0.75	0.23	0.15	0.26	0.39	0.42	0.16	0.16	0.41	0.12	0.12	0.48
Vanadium	11.50	35.8	22.16	6.67	23.64	11.5	27.6	32.2	22.8	23.3	14.8	14.2	28.2
Zinc	36.20	126	73.07	20.52	77.75	36.2	104	87.1	64.9	72.2	59	45.6	64.8
Cyanide	0.22	0.41	0.29	0.04	0.30	0.235	0.33	0.28	0.275	0.3	0.25	0.24	0.32

Notes:

1) This table presents chemical analysis results from subsurface soil samples taken across SEDA.

2) For statistical calculations, all detects (no qualifier or J qualifier) were taken at full value, and all non-detects (U or UJ qualifier) were taken at half value.

3) The samples are from: Ash Landfill, OB Grounds, SEAD-4, SEAD-11, SEAD-12, SEAD-13, SEAD-16, SEAD-17, SEAD-24, SEAD-25, SEAD-26, SEAD-64, SEAD-67, and SEAD-70.

4) The "H" statistic was used to calculate the 95th UCL of lognormally distributed data.

5) "R" qualifier indicates data were rejected during data validation.

6) "NA" indicates that chemical analysis results for the compound were not determined.

Background data from 10 and 15 SWMU investigations are in this table

Table 1-2

Statistical Comparison o Background Concentrations of Metals (mg/Kg) in Soils at SEDA

SEAD-16 and SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Total Samples: 53

Compound	Minimum Soils	Maximum Soils	Average Soils	Standard Deviation	95th Upper Confidence Limit (4)	SEAD-67 MW67-2.02 2-4 ft	SEAD-67 MW67-2.03 4-5 ft	SEAD-70 MW70-1.00 0-0.2 ft	SEAD-70 MW70-1.02 2-4 ft	SEAD-70 MW70-1.03 4-6 ft
Compound	Minimum Soils	Maximum Soils	Average Soils	Standard Deviation	95th Upper Confidence Limit (4)	SEAD-67 MW67-2.02 2-4 ft	SEAD-67 MW67-2.03 4-5 ft	SEAD-70 MW70-1.00 0-0.2 ft	SEAD-70 MW70-1.02 2-4 ft	SEAD-70 MW70-1.03 4-6 ft
Aluminum	5560.00	21200	13736.73	4490.13	14732.69	14900	9460	12200	9480	11000
Antimony	0.08	6.8	2.64	2.18	3.13	0.22	0.1	0.115	0.105	0.095
Arsenic	2.70	21.5	5.55	2.80	6.19	4.5	4.2	5.4	4.1	5.7
Barium	33.90	159	81.33	27.06	87.33	105	80.8	67.5	56.6	79.9
Beryllium	0.27	1.4	0.68	0.25	0.73	0.61	0.4	0.44	0.41	0.54
Cadmium	0.01	2.9	0.59	0.73	0.91	0.11	0.12	0.57	0.43	0.8
Calcium	1370.00	293000	45158.55	48324.39	100584.67	79000	77800	3600	51600	48600
Chromium	10.30	35.8	20.94	6.43	22.36	22.5	14.8	13.7	14.7	17.8
Cobalt	5.20	29.1	11.39	4.33	12.35	10.4	9.7	5.5	7.1	21
Copper	9.70	62.8	21.39	7.70	23.10	20.3	20.5	12.4	19.7	33.5
Iron	8770.00	42500	25221.27	7436.42	26870.76	24400	18700	17700	16000	26400
Lead	5.40	45.5	12.93	6.69	14.64	9.3	8.5	20.7	9.1	13.6
Magnesium	2830.00	29100	10429.64	6033.43	11767.92	15600	20900	2830	13600	7980
Manganese	207.00	2380	599.24	340.06	677.57	528	411	233	470	1040
Mercury	0.01	0.5	0.05	0.07	0.06	0.01	0.02	0.1	0.03	0.02
Nickel	12.30	62.3	31.58	11.07	34.03	32.3	25.9	12.3	17.6	52.4
Potassium	901.00	3460	1655.29	592.74	1786.77	3160	1970	982	1590	1350
Selenium	0.05	2.1	0.41	0.45	0.59	0.18	0.17	1	0.64	0.16
Silver	0.04	0.87	0.34	0.26	0.39	0.075	0.07	0.08	0.07	0.07
Sodium	8.45	269	90.12	54.38	102.18	112	107	18.2	126	165
Thallium	0.08	0.75	0.23	0.15	0.26	0.17	0.16	0.185	0.165	0.155
Vanadium	11.50	35.8	22.16	6.67	23.64	24.8	16.5	23.3	17.2	17.6
Zinc	36.20	126	73.07	20.52	77.75	62	60.1	55.4	42.4	116
Cyanide	0.22	0.41	0.29	0.04	0.30	0.25	0.27	0.32	0.295	0.24

Notes:

1) This table presents chemical analysis results from subsurface soil samples taken across SEDA.
2) For statistical calculations, all detects (no qualifier or J qualifier) were taken at full value, and all non-detects (U or UJ qualifier) were taken at half value.
3) The samples are from: Ash Landfill, OB Grounds, SEAD-4, SEAD-11, SEAD-12, SEAD-13, SEAD-16, SEAD-17, SEAD-24, SEAD-25, SEAD-26, SEAD-64, SEAD-67, and SEAD-70.
4) The "H" statistic was used to calculate the 95th UCL of lognormally distributed data.
5) "R" qualifier indicates data were rejected during data validation.
6) "NA" indicates that chemical analysis results for the compound were not determined.

Background data from 10 and 15 SWMU investigations are in this table

beds of Pleistocene glacial drift. Overall, the groundwater in the county is very hard, and therefore, the quality is minimally acceptable for use as potable water. Approximately 95 percent of the wells in the county are used for domestic or farm supply and the average daily withdrawal is approximately 500 gallons, or 0.35 gallons per minute (gpm). About five percent of the wells in the county are used for commercial, industrial, or municipal purposes. Seneca Falls and Waterloo, the two largest communities in the county, are in the hydrogeologic region which is most favorable for the development of a groundwater supply. However, because the hardness of the groundwater is objectionable to the industrial and commercial establishments operating within the villages, both villages utilize surface water (Cayuga Lake and Seneca River, respectively) as their municipal supplies. The villages of Ovid and Interlaken, both of which are without substantial industrial establishments, utilize groundwater as their public water supplies. Ovid obtains its supply from two shallow gravel-packed wells, and Interlaken is served by a developed seepage-spring area.

Regionally, the water table aquifer of the unconsolidated surficial glacial deposits of the region would be expected to flow in a direction consistent with the dropping ground surface elevations. Geologic cross-sections from Seneca Lake and Cayuga Lake have been constructed by the State of New York, (Mozola, 1951). This cross-section information, along with groundwater flow directions established at numerous sites on SEDA and stream drainage patterns in the area, suggests that a groundwater divide exists approximately half way between the two finger lakes; the divide is believed to run approximately parallel to Route 96 near the eastern boundary of SEDA. Further evidence for the divide is provided in Parsons ES (1995). SEDA is located on the western slope of this divide and, therefore, regional groundwater flow on the depot is expected to be west toward Seneca Lake.

A substantial amount of information concerning the hydrogeology in the area has also been compiled by Mozola (1951). This report has been reviewed in order to better understand the hydrogeology of the area surrounding SEDA. The report indicates that within a four (4) mile radius of SEDA there are a number of wells from which geologic and hydrogeologic information is available. This information includes: 1) the depth; 2) the yield; and 3) the geological strata through which the wells were drilled. Although the information was compiled in the 1950s, these data are useful in providing an understanding and characterization of the aquifers present within the area surrounding SEDA.

collected at Syracuse, New York, which is 40 miles northeast of SEDA. Meteorological data collected at Seneca Army Depot Activity and Ithaca, NY were used to prepare the wind roses presented in Figure 1-13.

A cool climate exists at SEDA with temperatures ranging from an average of 23°F in January to 69°F in July. Marked temperature differences are found between daytime highs and nighttime lows during the summer and portions of spring and autumn. Precipitation is unusually well-distributed throughout the year, averaging approximately 3 inches per month. This precipitation is derived principally from cyclonic storms that pass from the interior of the country through the St. Lawrence Valley. Lakes Seneca, Cayuga, and Ontario provide a significant amount of the winter precipitation and moderate the local climate. The annual average snowfall is approximately 100 inches. Wind velocities are moderate, but during the winter months, there are numerous days with sufficient winds to cause blowing and drifting snow. The most frequently occurring wind directions are westerly and west-southwesterly.

Daily precipitation data measured at the Aurora Research Farm in Aurora, New York for the period (1957-1991) were obtained from the Northeast Regional Climate Center at Cornell University. The average monthly precipitation during this 35-year period of record is summarized in Figure 1-14. The maximum 24-hour precipitation measured at this station during this period was 3.9 inches on September 26, 1975. Values of 35 inches mean annual pan evaporation and 28 inches for annual lake evaporation were already reported in Table 1-3. An independent value of 27 inches for mean annual evaporation from open water surfaces was estimated from an isoplethed figure in "Water Atlas of the United States" (Water Information Center, 1973).

In general, climatological conditions that tend to promote good dispersions are high ambient temperatures, high wind speeds, low precipitation amounts, and a preponderance of clear skies. As Table 1-3 shows, temperatures tend to be highest from June through September. Precipitation and relative humidity tend to be rather high throughout the year. The months with the most amount of sunshine are June through September. Mixing heights tend to be lowest in the summer and during the morning hours. Wind speeds also tend to be lower during the morning, which suggests that dispersion will often be reduced at those times, particularly during the summer. However, no episode-days are expected to occur with low mixing heights (less than 500 m) and light wind speeds (less than or equal to 2 m/s). Information on the frequency of inversion episodes for a

Table 1-3

Climatological Data for Seneca Army Depot Activity

SEAD-16 and SEAD-17 Remedial Investigation
Seneca Army Depot Activity

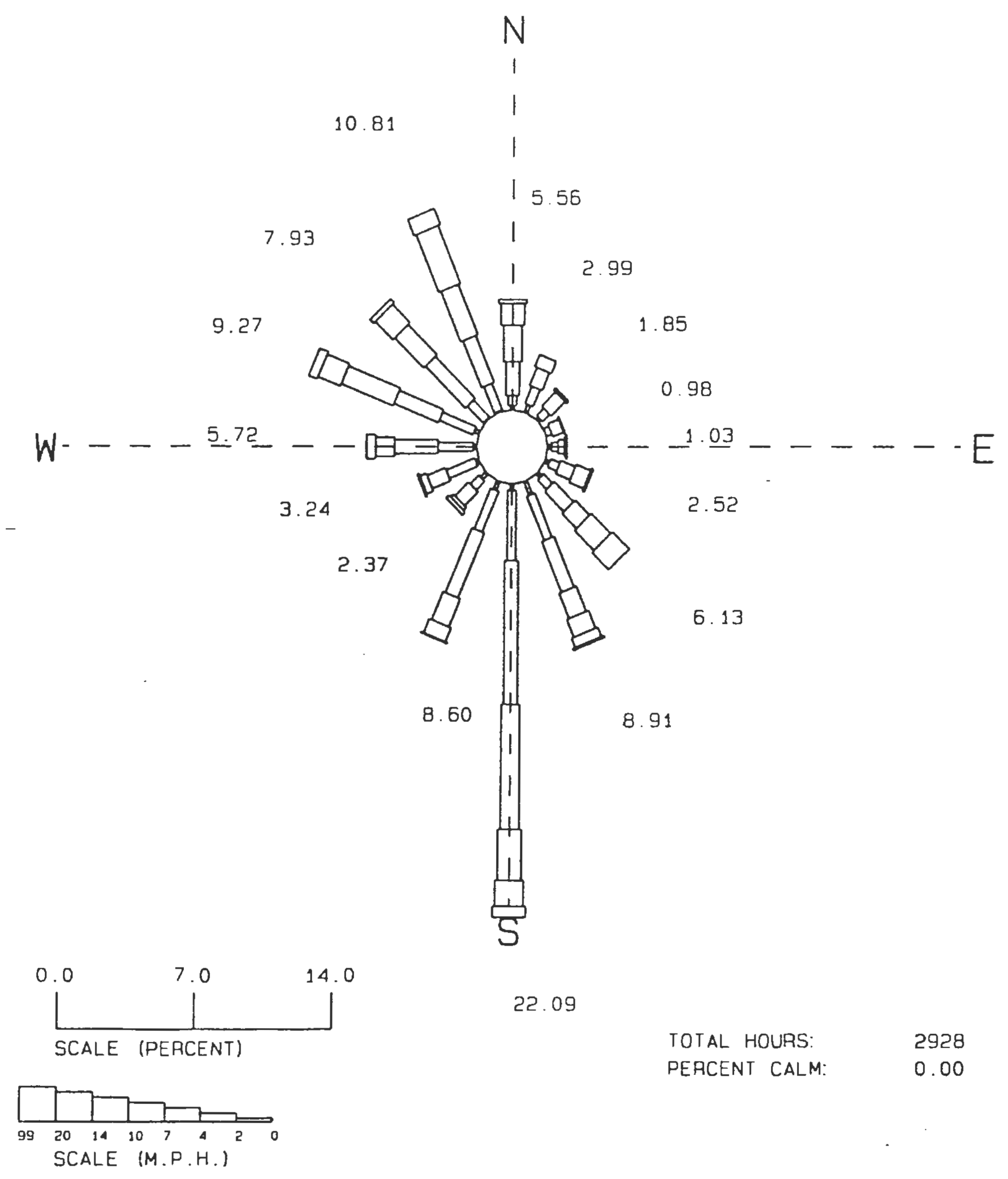
Month	Temperature (1),°F			Mean Precip-itation (1), in.	Mean Relative Humidity (%)	Percent Sunshine	Mean Number of Days (4)		
	Maximum	Minimum	Mean				Clear	Partly Cloudy	Cloudy
January	30.9	14.0	22.5	1.88	70	35	3	7	21
February	32.4	14.1	23.3	2.16	70	50	3	6	19
March	40.6	23.4	32.0	2.45	70	50	4	7	20
April	54.9	34.7	44.8	2.86	70	50	6	7	17
May	66.1	42.9	54.5	3.17	70	50	6	10	15
June	76.1	53.1	64.6	3.70	70	60	8	10	12
July	80.7	57.2	69.0	3.46	70	60	8	13	10
August	78.8	55.2	67.0	3.18	70	60	8	11	12
September	72.1	49.1	60.7	2.95	70	60	7	11	12
October	61.2	39.5	50.3	2.80	70	50	7	8	16
November	47.1	31.4	39.3	3.15	70	30	2	6	22
December	35.1	20.4	27.8	2.57	70	30	2	5	24
Annual	56.3	36.3	46.3	34.33	70	50	64	101	200

Period	Mixing Height (2), m	Wind Speed (2), m/s
Morning (Winter)	900	8
Morning (Spring)	700	6
Morning (Summer)	500	5
Morning (Autumn)	600	5
Morning (Annual)	650	6
Afternoon (Winter)	900	8
Afternoon (Spring)	1600	8
Afternoon (Summer)	1800	7
Afternoon (Autumn)	1300	7
Afternoon (Annual)	1400	7

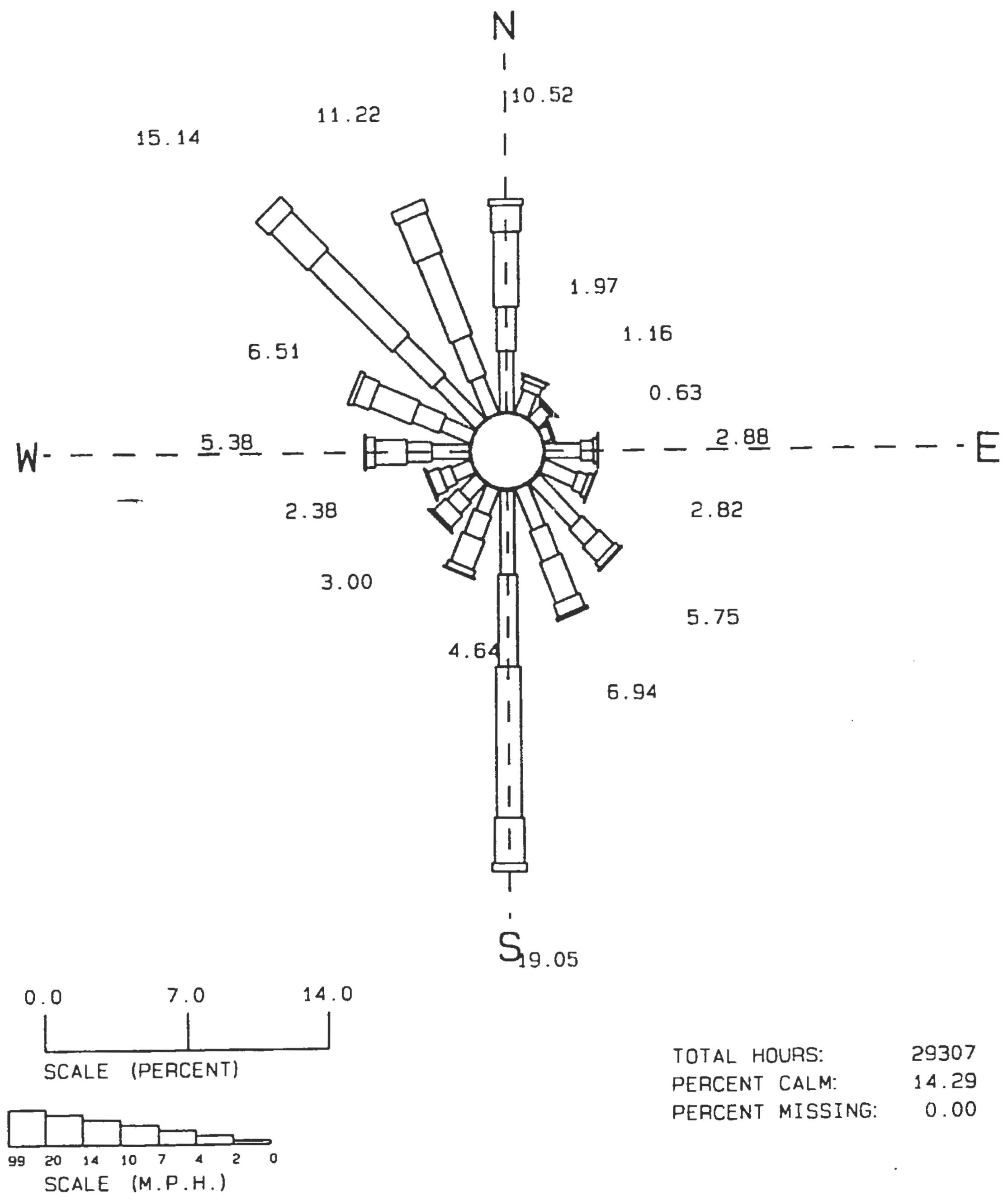
Mean Annual Pan Evaporation (3), inches : 35
Mean Annual Lake Evaporation (3), inches : 28

Number of episodes lasting more than 2 days (2), (No. of episode-days) :
Mixing Height < 500 m, wind speed < 2 m/s : 0 (0)
Mixing Height < 1000 m, wind speed < 2 m/s : 0 (0)
Number of episodes lasting more than 5 days (2), (No. of episode-days) :
Mixing Height < 500 m, wind speed < 4 m/s : 0 (0)

Notes:
1) Climate of New York Climatography of the United States No. 60. National Oceanic and Atmospheric Administration, June 1982. Data for Ithaca Cornell University, NY.
2) Mixing Heights, Wind Speeds, and Potential for Urban Air Pollution throughout the Contiguous United States. George C. Holzworth, Jan. 1972.
3) Climate Atlas of the United States. U.S. Department of Commerce, 1983.
4) Climate of New York Climatography of the United States No. 60. National Oceanic and Atmospheric Administration, June 1982. Data for Syracuse, NY.



SENECA 10-M MET. TOWER
SEASONAL WIND ROSE
10 METER LEVEL APRIL 24 - JULY 14 1995



ITHACA AIRPORT
ANNUAL WIND ROSE
20 FOOT LEVEL POR: 1989-1993

PARSONS
PARSONS ENGINEERING SCIENCE, INC.

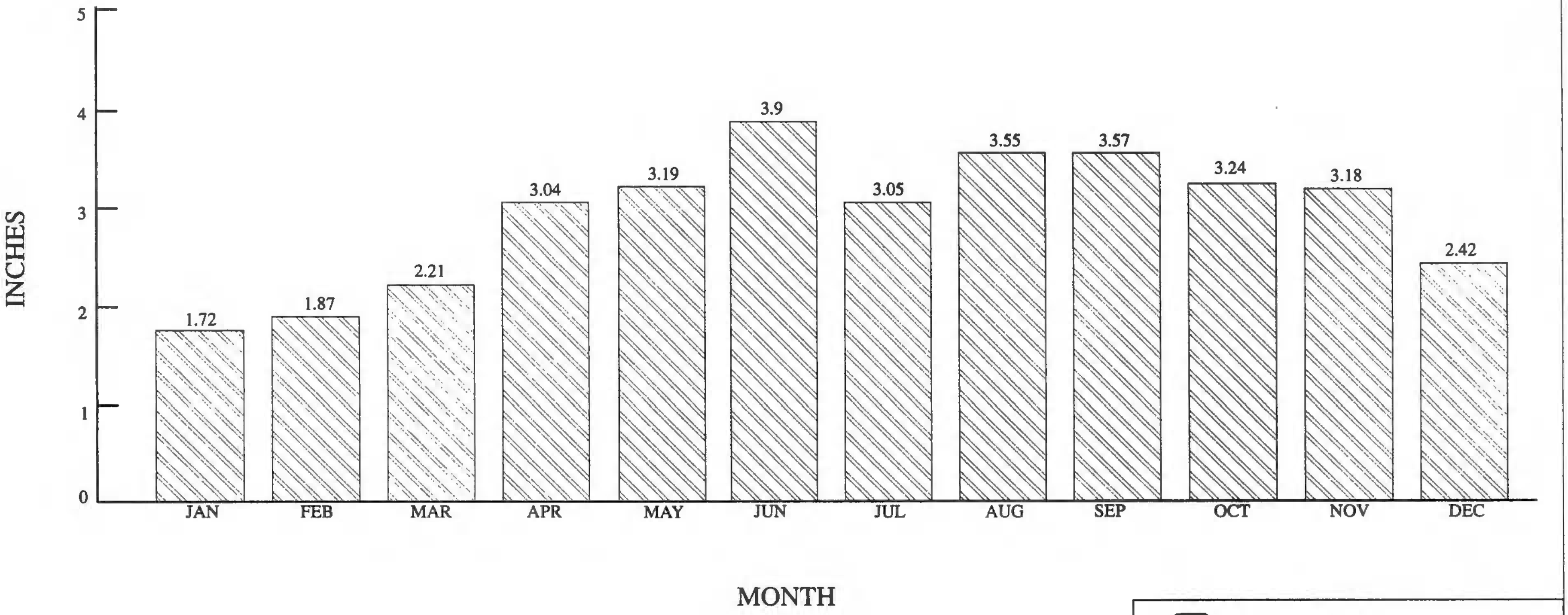
CLIENT/PROJECT TITLE
SENECA ARMY DEPOT ACTIVITY
RI/FS
SEAD16 AND SEAD 17

DEPT. ENVIRONMENTAL ENGINEERING
DWG NO 729895-01001

FIGURE 1-13
WIND ROSES

SCALE NA
DATE JANUARY 1997

GRAPHICS\SENECA\2WROSES.CDR



Data is from the Northeast Regional Climate Center, Cornell University, Ithaca, NY and is given as a monthly average precipitation averaged over the years 1958 through 1991.

PARSONS
PARSONS ENGINEERING SCIENCE, INC.

CLIENT/PROJECT TITLE
SENECA ARMY DEPOT ACTIVITY
RI/FS
SEAD-16 and SEAD-17

DEPT. ENVIRONMENTAL ENGINEERING	DWG NO. 729895-01001

FIGURE 1-14

AVERAGE MONTHLY PRECIPITATION IN PROXIMITY OF SENECA ARMY DEPOT ACTIVITY
(1958-1991)

SCALE	DATE NOVEMBER 1996

R:\GRAPHICS\SENECA\HISTO.CDR(CVM)

number of National Weather Service stations is summarized in "Mixing Heights, Wind Speeds, and Potential for Urban Air Pollution Throughout the Contiguous United States" (George C.Holzworth, US EPA, 1972). The closest stations at which inversion information is available are Albany, New York and Buffalo, New York. The Buffalo station is nearer to SEDA but almost certainly exhibits influences from Lake Erie. These influences would not be expected to be as noticeable at SEDA. SEDA is located in the Genesee-Finger Lakes Air Quality Control Region (AQCR). The AQCR is designated as "non-attainment" for ozone and "attainment" or "unclassified" for all other criteria pollutants. Data for existing air quality in the immediate area surrounding the SEAD, however, can not be obtained since the nearest state air quality stations are 40 to 50 miles away from the depot (Rochester of Monroe County or Syracuse of Onondaga County). A review of the data for Rochester, which is in the same AQCR as SEDA, indicates that all monitored pollutants (sulfur dioxide, particulates, carbon monoxide, lead, ozone) are below state and federal limits, with the exception of ozone. In 1987, the maximum ozone concentration observed in Rochester was 0.127 ppm. However, this value may not be representative of the SEDA area which is in a more rural area.

1.5.7 Regional/Local Land Use

Historically, Varick and Romulus Townships within Seneca County developed as agricultural centers supporting a rural population, however, there was a significant increase in the populations of these two centers in 1941 when SEDA was opened.

Land use in the region surrounding SEDA is largely agricultural, with some forestry and public land uses (i.e., school, recreation, and state parks) (Figure 1-15). Agricultural land uses are categorized as inactive or active use. Inactive agricultural land consists of land committed to eventual forest regeneration, land waiting to be developed, or land presently under construction. Active agricultural land surrounding SEDA consists largely of cropland and cropland pasture. The USGS quadrangle maps for the Towns of Ovid and Dresden, New York (1970), New York State Department of Transportation (DOT) quadrangles for Romulus, New York (1978) and Geneva South, New York (1978) do not indicate land designated for dairy production in the vicinity of SEDA. Forested land adjacent to SEDA is primarily under regeneration although there are sporadic occurrences of mature forest.

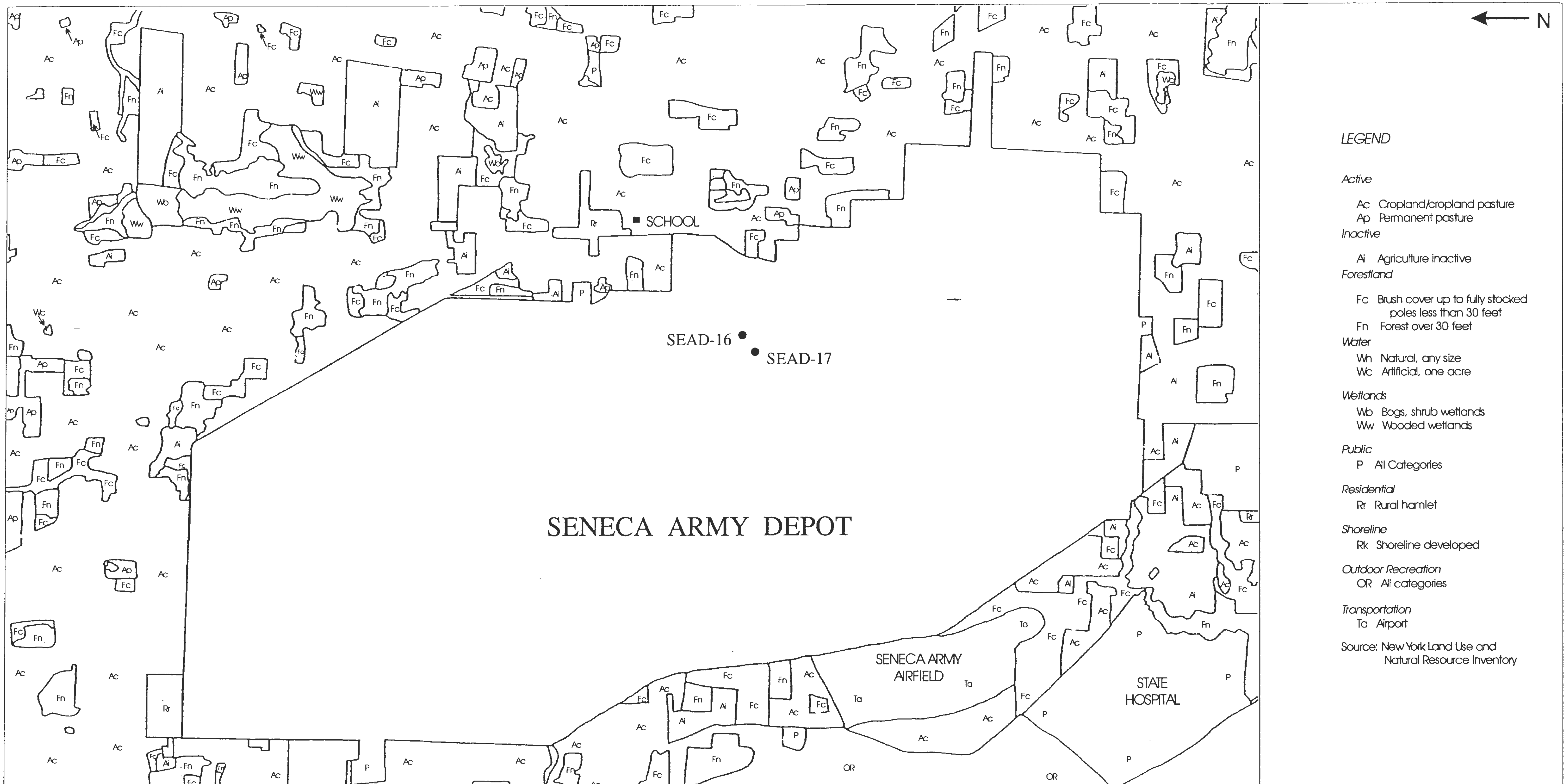
Public and semi-public land use surrounding and within the vicinity of SEDA includes Sampson State Park, Willard Psychiatric Center, and Central School (at the Town of Romulus, New York). Sampson State Park encompasses approximately 1,853 acres of land and includes a boat ramp on Seneca Lake.

1.6 OFF-SITE WELL INVENTORY

The section identifies private drinking water wells near SEAD-16 and SEAD-17. Knowledge of off-site wells is required when assessing any potential threats to drinking water supplies from releases at the sites being investigated. No private homes with private drinking water wells were identified within a one-mile radius of both SEAD-16 and SEAD-17 (Figure 1-16). The closest wells are located on Yerkes Road east of Route 96. There are no public water supply wells within a one-mile radius of the sites.

1.7 REPORT ORGANIZATION

The remaining sections of this report describe the investigation programs, the results of the data collected during the RI and identify the magnitude and extent of impacts at the two sites. For clarity throughout the RI report, the discussions of SEAD-16 and SEAD-17 are for the most part kept separate. The first part of Section 2.0 (Study Area Investigation) presents the methodologies used during the field investigations. This is followed by a discussion of the technical approach of the RI and the rationale for choosing the locations investigated during the field program. This section relates the investigation programs (i.e., geophysical, surface water and sediment, soils, groundwater, and ecological) to the important site features and characteristics, and sources of contamination. Section 3.0 discusses the results of the investigation programs, specifically, surface features, ecology, surface water hydrology and sediments, geology and hydrogeology. The nature and extent of contamination on and off-site is discussed in Section 4.0. Section 5.0 (Contaminant Fate and Transport) provides a discussion of the mechanisms involved in the weathering and transport of constituents found at the site. Sections 6.0 and 7.0 (Baseline Risk Assessments at SEADs 16 and 17, respectively) evaluates the risk to human health and the environment. Section 8.0 (Summary) presents a summary discussion of the results. Appendices are included in a separate volume and contain the supporting data for this report.



PARSONS
PARSONS ENGINEERING SCIENCE, INC.

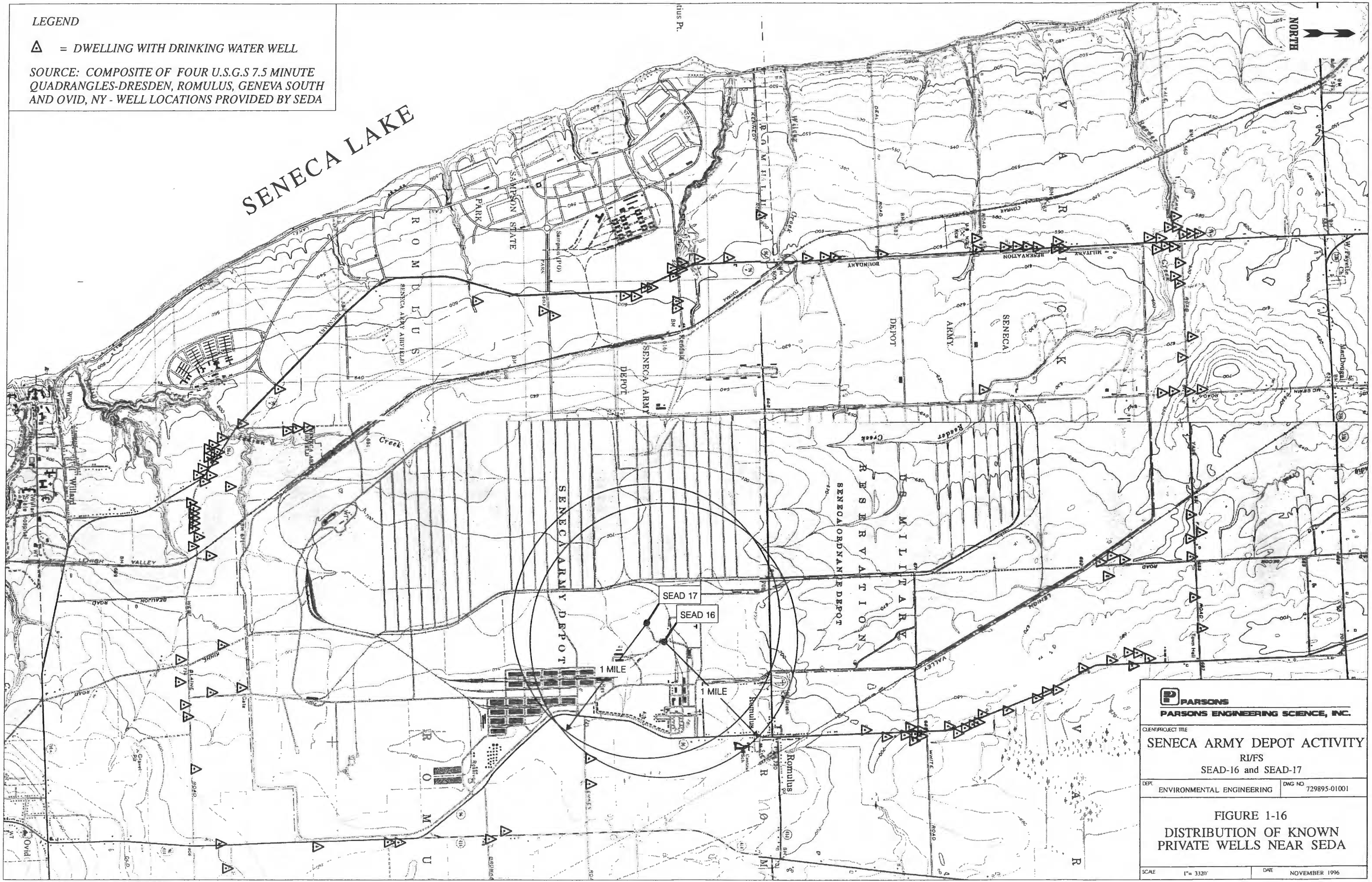
SENECA ARMY DEPOT ACTIVITY
RI/FS
SEAD-16 and SEAD-17

DEPT. ENVIRONMENTAL ENGINEERING	DWG NO. 729895-01001

FIGURE 1-15
REGIONAL/LOCAL
LAND USE MAP

SCALE 1" = 2000'	DATE NOVEMBER 1996

r:\graphics\seneca\basemap\zoning\lanuse.cdr(cvm)



LEGEND

△ = *DWELLING WITH DRINKING WATER WELL*

SOURCE: COMPOSITE OF FOUR U.S.G.S 7.5 MINUTE QUADRANGLES-DRESDEN, ROMULUS, GENEVA SOUTH AND OVID, NY - WELL LOCATIONS PROVIDED BY SEDA

PARSONS

PARSONS ENGINEERING SCIENCE, INC.

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT ACTIVITY
RI/FS
SEAD-16 and SEAD-17

DEPT. ENVIRONMENTAL ENGINEERING
DWG NO. 729895-01001

FIGURE 1-16
DISTRIBUTION OF KNOWN PRIVATE WELLS NEAR SEDA

SCALE 1"= 3320'
DATE NOVEMBER 1996

R:\GRAPHICS\SENECA\WELLOC.CDR AND WELS1617.CDR

2.0 STUDY AREA INVESTIGATION

2.1 INTRODUCTION

A conceptual understanding of the site conditions at SEAD-16 and SEAD-17 was developed as part of this CERCLA investigation. This investigation combined the present data with additional hydrologic, geologic, ecological, and chemical information that was obtained from the previously completed ESI to provide a comprehensive CERCLA Remedial Investigation report.

This CERCLA investigation was conducted in two phases. The first phase of the investigation was the ESI, which began in the fall of 1993. A detailed description of the tasks associated with each phase of this program is presented in the Workplan for CERCLA Expanded Site Investigation (ESI) of Ten Solid Waste Management Units (Parsons ES, January 1993), hereafter referred to as the Ten SWMU ESI Workplan. The Expanded Site Inspection of Seven High Priority SWMUs Report (Parsons ES, 1995), which included SEAD-16 and SEAD-17, was prepared after the completion of the ESI fieldwork and provided the basis for the work required to complete the remedial investigation.

The second phase of the CERCLA investigation was the RI, which began with the field program in the summer of 1996. The description of the tasks involved with each phase of this program were presented in two documents. The first document was the Generic Installation Remedial Investigation/Feasibility Study (RI/FS) Workplan (Parsons ES, 1995b), hereafter referred to as the Generic RI/FS Workplan. The second document was the SEAD-16 and SEAD-17 Project Scoping Plan for Performing a CERCLA RI/FS (Parsons ES,1995c). The following sections describe, in detail, the ESI and RI work completed by Parsons ES to further characterize the environmental setting and chemical impacts at the sites.

The Ten SWMU ESI workplan was approved by the U.S. Environmental Protection Agency (EPA), Region II, and NYSDEC, prior to initiation of fieldwork in November 1993. The Generic RI/FS workplan was approved by the EPA Region II and NYSDEC in September 1995. Subsequent to this approval, revisions were made to the Generic RI/FS workplan in May 1996 in response to further comments made by the EPA. The SEAD-16 and SEAD-17 Project Scoping Plan was finalized in December 1995. Together, the workplans described the following field tasks:

- Surveying (ESI and RI),
- Geophysical Investigation (ESI),
- Soil Sampling (ESI and RI),

- Groundwater Investigation (RI),
- Surface Water/Sediment Investigations (ESI and RI),
- Ecological Investigation (RI), and
- Building Investigation (ESI and RI).

In section 2.2 that follows, the general methods and materials used for the ESI and RI are presented. This is followed by information specific to the field investigations at both SEAD-16 and SEAD -17. (Sections 2.3 and 2.4).

2.2 METHODS AND MATERIALS

2.2.1 Site Survey Program

Two site survey programs were conducted at SEAD-16 and SEAD-17, one for the ESI field program and one for the RI field program.

The initial site survey program, which was conducted for the ESI, consisted of field reconnaissance, ground control, aerial photogrammetry, and a field survey of the location, identification, and elevation of monitoring wells, soil borings, geophysical lines, and any other sampling points associated with the ESI field program. A reconnaissance of the sites was performed to locate general site features and confirm the presence of significant features (i.e., buildings, utilities access roads, sample locations, etc.) identified in the Ten SWMU ESI Workplan. All sample locations were identified and marked during this initial survey. SEDA was photographed from the air on December 14, 1993 for the purpose of constructing a photogrammetric site plan with 2-foot contour intervals. This photogrammetric map was used as the basis for individual site base maps. Ground control was performed during the period from November of 1993 through February of 1994.

For the RI field program, the site survey consisted of field reconnaissance and a field survey. Again, the site reconnaissance was performed to locate general site features and confirm the presence of significant features identified in the SEAD-16 and SEAD-17 Project Scoping Plan. All sample locations were identified and marked with stakes and flagging during this initial survey. Consideration was also given to the accessibility of the site with regard to drilling rigs and heavy machinery.

Monitoring wells were located and surveyed upon completion of the ESI field program, and the RI field program. All sample locations and Monitoring well locations were surveyed after the surface completion and installation of the locking cap guard pipe. At each monitoring well location, three elevations were measured: the top of the outer protective casing at the point opposite the lock or bolt on the guard pipe, the top of the inner PVC riser pipe, and at the finished concrete pad adjacent to the outer well casing. All of the surveyed locations were referenced to the New York State Plane Coordinate System.

The site surveys for the ESI and RI at SEAD-16 and SEAD-17 were combined to form the basis for complete survey for the RI, and they provide accurate site base maps that were used for the following purposes:

1. Mapping the direction of groundwater flow and computing the velocity of groundwater;
2. Locating the environmental sampling points associated with the RI field program;
3. Estimating the volume of impacted soils and sediments which may require a remedial action;
4. Mapping the extent of any impacted groundwater above established ARAR limits; and
5. Providing accurate and current information regarding the topography and site conditions.

The location, identification, coordinates, and elevations of all control points and all of the environmental sampling points were plotted on the site base maps to show their location with respect to surface features within the project area. The SEAD-16 and SEAD-17 site plans are presented in Figures 1-3, and 1-4, respectively.

2.2.2 Geophysical Investigation

The geophysical investigation surveys were conducted at SEAD-16 and SEAD-17 during the ESI field investigation. The surveys consisted of seismic refraction surveys at both sites.

2.2.2.1 Seismic Refraction

Seismic refraction surveys were performed at SEAD-16 and SEAD-17 during the ESI to determine, on a preliminary basis, the direction of groundwater flow by measuring either the depth to the water table or the depth to bedrock. These data, along with topographic information, were used to more accurately locate the up and downgradient monitoring wells.

Four 115-foot seismic refraction transects were laid out at each site. In general, each transect was approximately equidistant from each other and the center of the site with each transect pointing toward the center of the site. The shot point locations were located along each profile and were used to define each individual seismic spread. The seismic data were collected using an industry standard 24-channel seismograph. When the geophones were placed on asphalt or concrete, small metal base plates replaced the metal spike on each geophone. The geophones placed on asphalt or concrete were weighted down using small 2- to 3-pound sand bags to improve overall coupling with the ground and to help minimize background noise. Geophone spacings were held at 5-foot intervals throughout the survey.

Once the seismograph setup was complete and data collection was ready to commence, the background noise level at each geophone location was monitored. The background noise was displayed on the seismograph CRT as a series of moving bars, the amplitude of which is proportional to the background noise level. This review provided information on ambient noise levels, while also highlighting any malfunctioning geophones. Geophones that displayed a high level of noise were moved or had their placement adjusted.

An impact or dropped weight was used as the seismic energy source. Due to the shallow nature of the water table and bedrock interfaces (i.e., generally less than 10 feet in depth) a low energy source was considered sufficient to accurately image one or both of these surfaces. Three shots were fired for each geophysical spread, with the shot points located at the spread ends and spread center. A paper copy of each seismic record was made in the field. Each record was reviewed for quality to insure that adequate signal to noise levels were present for the shot. Upon initial acceptance, a preliminary velocity analysis was performed in the field to define the subsurface structure along each spread. This preliminary review focused on determining if the water table and/or the bedrock surface had been properly resolved. Upon final acceptance of each shot, the seismic record was annotated to identify the transect number, the spread number, the shot point number, and the shot point location. After each record was reviewed, accepted, and annotated, the data collection procedure was repeated for the remainder of the shot points for each spread.

Subsequent to the seismic data collection, a survey was performed to provide State Plane Coordinates for the seismic shot points. These data were used during reduction and seismic modeling.

The seismic refraction method relies upon the analysis of the arrival times of the first seismic energy at each geophone location to provide details about the subsurface geology. The time when the seismic energy arrives at each geophone location is referred to as the first break. Each seismic record was reviewed, using both the seismograph CRT and the paper records, to determine the first breaks at each geophone. This analysis was primarily performed in the field and the data was checked after the completion of the field program. These first break data values were tabulated and used to create time-distance plots as described below.

For each seismic spread, a graph was made of the first break determinations for all of the spread shot points. These graphs display, in an X-Y plot, the first breaks (time) versus the geophone locations (distance). These time-distance plots form the basis of the geophysical interpretation. The time-distance plots were individually analyzed to assign each first break arrival to an assumed layer within the subsurface. It was estimated that up to four distinct seismic layers exist at the site. These include the unsaturated and saturated surficial deposits, the weathered bedrock, and the competent bedrock. In general, these various layers can be grouped into broad ranges of seismic velocities. As an example, unsaturated deposits will generally have a seismic velocity of less than 2,500 feet per second. By comparison, the saturated deposits should have seismic velocities in the range of 4,500 to 5,500 feet per second. The time-distance plots were interpreted to yield the velocity distribution within the subsurface. Each first break arrival was assigned to one of the above mentioned layers. This velocity analysis and layer assignment formed the basis for the data files to be used during the seismic modeling.

Once the first break analysis and layer assignments were complete, input seismic data files were created for use in the seismic modeling software. The input files included all of the information pertaining to the spread geometry, shot point locations and depths, first break arrivals, and layer assignments, and elevation data. The computer program SIPT (Scott, 1977) was used to model the seismic data. SIPT is an interactive computer program developed by the United States Geological Survey for the inverse modeling of seismic refraction data. This program uses input seismic refraction data to create two-dimensional cross-sectional models of velocity layering within the subsurface. The program uses the delay time method to produce a first approximation of the subsurface velocity layering. This approximation is then refined through the use of iterative ray tracing and model adjustment to minimize the differences between field measured first arrival times and the forward modeled ray-path times. The program also provides various levels of velocity analyses that are reviewed to provide diagnostic information on the model solutions.

The results of the computer modeling were then reviewed inlight of the known geology of the site. The subsurface velocity layering was attributed to known or expected geologic units. A detailed analysis was made of the velocity distribution of the upper, unsaturated materials to ensure that near surface low velocity materials were not adversely affecting the data quality and interpretation. The velocity distribution within the bedrock was also reviewed to provide information on the presence and degree of weathering and to identify any lithologic or fracture related changes within the bedrock.

Based upon the seismic refraction data and the logs from the various monitoring wells, two seismic cross-sections were generated for each site. These cross-sections show the land surface elevation and the elevation of the water table and/or bedrock surfaces.

2.2.3 Building Investigation

A building investigation was conducted for the ESI and the RI field programs at SEAD-16. The investigation consisted of the collection of solid materials from the two buildings at the site and air samples from the Abandoned Deactivation Furnace (Building S-311). Residue samples were analyzed for asbestos and floor samples underwent chemical and asbestos analyses. Air samples were obtained by several different sampling methods and were submitted for chemical analysis of asbestos, metals, and semivolatile organic compounds (SVOCs). Also, during the ESI, two standing water samples were collected from inside Building S-311.

2.2.3.1 Material Sampling

Propellants

At SEAD-16, propellants may be present in pipes associated with former manufacturing or deactivation processes. To determine whether the propellants could be safely sampled and analyzed, residue in the pipes were sampled and tested by UXO personnel. If the material was determined to be safe to handle, it was sampled and analyzed.

Propellants were sampled using a decontaminated stainless steel implement that would scrape residue from the inner wall of the pipe. The propellants were transferred to a decontaminated stainless steel bowl, then placed into the appropriate sample bottles.

Asbestos

Asbestos, once commonly referred to as the miracle mineral, has been used as a reinforcement fiber for more than 3,000 years. Because of the abundant availability of the fiber, its acoustic and tensile qualities, and its resistance to fire and chemicals, asbestos has been used extensively in building materials since before the turn of the century. Asbestos-containing building materials (ACBM) has become a major item of concern with building renovations and demolition.

Inhalation of asbestos fibers has recently been found to be a health hazard to humans. For this reason the United States Environmental Protection Agency (USEPA), under the authority granted by the Clean Air Act (National Emission Standards for Hazardous Air Pollutants), requires removal of all regulated asbestos-containing materials likely to be disturbed during work activities. Notifications are required to be submitted to USEPA, or its designated local agency, outlining asbestos-containing materials likely to be disturbed during renovation/demolition activities and proposed abatement methods for protection of public health. The burden of identifying what materials are asbestos-containing is placed on the building owner. In addition to notification requirements, a number of state and local agencies require submittal of an asbestos inspection report presenting results of an asbestos inspection conducted by a certified asbestos inspector.

Assessment Procedures

A complete survey and assessment of asbestos-containing building materials (ACBM) in buildings S-311 and 366 consists of the following steps:

1. Review of as-built drawings, other construction drawings, and building specifications; Interviews with mechanical personnel, HVAC personnel, boiler room personnel, and/or other appropriate facility personnel;

2. Visual inspection of each room and completion of standard building inspection forms for each room or area. Information collected during the survey includes a description of the floor, ceiling, and walls; an estimate of the amount, type, and condition of suspected ACBM; identification of the structures coated with suspected ACBM; and a description of any physical or operational constraints that may affect asbestos removal. A detailed description of the asbestos inspection follows;

3. Collection of bulk samples of suspected ACBM, such as: insulation on pipes and pipe fittings; boilers, ducts, and other equipment; resilient floor coverings; acoustical insulation; wall and ceiling plaster; and fireproof insulation. A detailed description of asbestos sampling procedures follows; and

4. Laboratory analysis of asbestos samples by an accredited laboratory (including Polarized Light Microscopy (PLM) with dispersion staining (EPA Method 600/M4-82.020) and Transmission Electron Microscopy Analysis (NYSDOH Method 198.4) for nonfriable organically bound (NOB) materials).

The inspection and sample collection was conducted by a New York State Certified Asbestos Inspector. The asbestos assessment report was in accordance with 12 NYCRR 56 pre-demolition inspection requirements.

Asbestos Inspection

An asbestos inspection, sampling, and sample analysis were conducted in order to identify and quantify accessible suspected asbestos-containing building materials (ACBM). The inspection consisted of a review of existing building plans, if available, to familiarize the certified inspector with the building layout, as well as to identify pipe chases and dead spaces; and a room by room walk-through of the building to determine the location, condition, quantity, and type (friable of non-friable) of suspect ACBM present. Access to all areas was required to ensure inspection of all accessible suspect ACBM. Suspect ACBM included surface materials (sprayed-on troweled-on wall and ceiling plasters, acoustical insulation, and fireproofing), thermal insulation (e.g., insulation on pipes, pipe fittings, tanks, boilers, and ducts), and miscellaneous materials (e.g., vinyl floor tile, roofing, baseboard molding, and vibration joint cloth). Suspect ACMB were located on building floor plans (either provided by the building owner or field drawn) to assist in development of the asbestos sampling plan and for inclusion in the final report.

An attempt was made to identify ACMB in areas not readily accessible (e.g., pipe chases and permanent drop ceilings) and in areas deemed unsafe. A "hand pressure test" was performed where feasible to determine material friability. Friable is defined by the USEPA as the ability to crush, pulverize or otherwise reduce to a powder state by hand pressure. The inspector noted the proximity of the suspect ACBM to assist in developing potential areas of concern. Sample areas (homogeneous areas of ACBM) were identified to determine appropriate sample locations and quantities. Building Inspection Forms were completed for documentation of inspection observations. Information included on this form included a description of all surfaces, ceiling height, estimation of type, quantity and condition of suspect ACBM, and a description of any physical or operational constraints that may effect abatement costs.

Sample Collection

Asbestos sampling of friable suspect ACBM was performed in an Asbestos Hazard Emergency Response Act (AHERA) format modified to address site-specific conditions, including access restrictions. Where appropriate, a random sampling scheme (as described in USEPA guidance Document 560/5-85-030a "Asbestos in Buildings: Simplified Sampling Scheme for Friable Surfacing Materials, October 1985) was used for the confirmation of the presence or absence of asbestos. Although based on past experience certain conditions are invariably encountered where random selection was not possible (i.e., excessive height of pipe runs and materials penetrating permanent barriers), an attempt was made to select sample locations so they best represented the defined sample area. A minimum of three samples of each suspected friable ACBM were collected in accordance with AHERA protocol, because ACBM is typically non-homogeneous and, consequently, unreliable conclusions can be drawn from the results of a single sample. At least three negative samples are generally necessary for friable suspect ACBM to be considered non-asbestos material. In order to minimize analytical costs and if appropriate, the laboratory was instructed to analyze sample triplets using the "first positive" strategy (i.e., if the first or second sample results indicate the presence of asbestos, then the remaining samples from the triplet will not be analyzed).

Sampling of non-friable suspect ACBM (i.e., floor tile, roofing material, vinyl sheeting, mastics, etc.) was handled on a case by case basis because limited regulatory guidance is available for collection of non-friable materials. In general, one to three samples were collected from non-friable suspect ACBM, depending on aerial coverage of material, access, and equipment or building occupant tolerance for destructive sampling. Unless requested otherwise, destructive sampling was kept to a minimum since past inspections have often been conducted a year or more prior to anticipated renovation/demolition work. For materials such as roofing, where compromising of structural integrity is a concern, sampling was avoided or limited to a preliminary screening type effort with recommendations for follow-up confirmation sampling prior to renovation/demolition.

One quality control sample (i.e., split sample) was collected for every 20 samples collected. The quality control sample was labeled and handled in the same manner as ordinary samples, and the laboratory did not know which samples were for quality control.

Samples and sample locations were identified by a unique sample identification number which was recorded on the sample container, the sampling area floor plan, sample data sheet, and the chain of custody form. Sample area was "patched" using caulk, duct tape, and/or paint to encapsulate any loose asbestos fibers and to provide marking for future reference.

Dust/Dirt

Dust and dirt on the floor of some of the buildings were sampled for various parameters. This material was sampled using the same procedures as for surface soils (Section 2.2.4.2) except that the dust and dirt may have been collected over a broad area of the floor rather than digging into the soil.

2.2.3.2 Indoor Air Sampling

Indoor air sampling consisting of one 24-hour event was conducted at the Abandoned Deactivation Furnace (Building S-311) over a two day period. The sampling devices were field calibrated and the actual sample collection initiated on the first day. After a 24-hour sampling period ending on the second day, all samples were collected and prepared for shipment to the analytical laboratory for off-site chemical analysis. Separate samples were collected for the analysis of asbestos, metals (excluding mercury), mercury, and semivolatile organic compounds.

During the single air sampling event, multiple samples representing the different sampling methodologies for the target compounds were collected at a total of three sites. Two of the sampling sites were located inside Building S-311 and the third site was located outside the building as a control site for establishing background ambient air levels for the target compounds. The outside sampling site was situated upwind with respect to the building being investigated (i.e., so the wind would be moving the air over this sampling location and toward, not from, the building), and its exact location was determined based on the observed wind direction just prior to the start of the sampling event and the forecast wind direction for the sampling period.

For quality assurance purposes, a colocated set of samples (i.e., field duplicate samples) for each of the four sampling methodologies employed as collected at one of the indoor sampling sites. The indoor site nearest to boilers No. 1 and No. 2 was designated as the colocated sampling site due to its close proximity to potential sources of target air contaminants.

Brief descriptions of the sampling method employed for each type of target compound are presented below:

Asbestos

A BGI, Incorporated asbestos sampling pump was used to draw sample air through a glass cartridge containing a 25mm diameter cellulose ester membrane. Sample air was drawn through the cartridge at a constant flow rate of approximately 3 liters per minute over a 24-hour period. The exposed cartridges were then sealed and sent to an environmental analytical laboratory for analysis.

Metals

Two different methods were employed to collect air samples for metals - one for mercury (gaseous phase) and the second for all other target metals.

Air samples for gaseous phase mercury were obtained using NIOSH Method 6009, which employs the use of a personal sampling pump to draw sample air through a glass sorbent tube. Sample air was drawn through the tube at a constant flow rate of approximately 0.2 liters per minute over a 24-hour period. The exposed tubes were then sealed and sent to an environmental analytical laboratory for anaylsis for mercury.

Air samples for all other target metals were obtained by the standard high-volume particulate sampling method, which is the USEPA reference method for determination of airborne total suspended particulate (TSP) concentrations in ambient air. Sample air was drawn through a quartz filter at a rate ranging between 39 and 60 (target 45) cubic feet per minute for a period of 24 hours using a standard TSP high-volume sampler. Metals existing in the air were collected on the filter, along with any other airborne particles. Following chemical analysis of the filter samples for specific metals, the individual metal concentrations were computed from the individual metal masses found on the filter and the total volume of sample air corrected to standard temperature and pressure.

Semivolatile Organic Compounds

Air samples for SVOCs were obtained by use of USEPA Method TO-13, which utilizes a modified high-volume sampler (referred to as a PUF sampler) in conjunction with a particulate filter and a combination of XAD-2 resin and polyurethane foam (PUF) adsorbent in a glass cartridge. The low level of some SVOCs in the ambient air requires the use of a relatively high-volume sampling technique to acquire sufficient sample for analysis. Therefore, the sampling rate was maintained at approximately 6 to 7 cubic feet per minute over the 24-hour sampling period to provide total air sample volumes of 8,500 to 10,200 cubic feet.

The sample collection media for SVOCs consisted of a filter (for particulate phase SVOCs) followed by an adsorbent glass cartridge filled with PUF/XAD/PUF (for gaseous phase SVOCs).

2.2.4 Soil Investigation

The objectives of the soils investigation program were to determine the nature and extent of chemical impacts within and around each site, to locate areas for potential removal action, to provide data on the background soil quality, and to provide a database for the risk assessment and feasibility study.

The soils investigation program was completed in accordance with the pre-approved Ten SWMU ESI Workplan (Parsons Main, Inc. January, 1993), the Generic Installation RI/FS Workplan (Parsons ES, 1995b), and the SEAD-16 and SEAD-17 Project Scoping Plan, (Parsons ES, 1995c). Sample locations were placed in source areas and at upgradient locations to establish background conditions. The locations of borings were at times adjusted slightly from those locations presented in the Ten SWMU ESI workplan based on the results of the geophysical investigations, which better defined the groundwater flow direction. The individual boring logs are included in Appendix A. Empire Soils Investigation, Inc. of Groton, New York performed the drilling for the ESI and the RI field programs. Parsons ES provided direction and oversight at all times for this subcontractor.

2.2.4.1 Soil Borings

Soil borings were performed using an Acker F-800 drilling rig for the ESI and a CME-550 drilling rig for the RI. Both rigs were equipped with 4.25-inch I.D. hollow stem augers. All borings were advanced to refusal which represented the depth of the competent bedrock. The determination of auger "refusal" in competent shale is somewhat subjective as the hollow stem augers can generally penetrate through the shale at a very slow rate. For the purposes of these studies, auger "refusal" in "competent" shale was defined as the depth (after penetrating the weathered shale) when augering became significantly more difficult and auger advancement was slow.

During drilling, soil samples were collected continuously during the boring using a decontaminated standard three-inch diameter, 2-foot long carbon steel split-spoon sampler according to the method described in ASTM D-1586-84. This technique involved driving a split-spoon sampler 2 feet into undisturbed soil with a rig-mounted 140 lb. hammer. Once the sample was collected from the split spoon, the augers were advanced to the top of the next sample interval. Samples were collected until spoon refusal on competent shale was encountered.

Soil samples were screened for volatile organic compounds using an Organic Vapor Meter (OVM) 580B. A MIE model PDM-3 Miniature Real-Time Aerosol Meter (Miniram) was also positioned on or near the drilling rig to detect dust. For the ESI, soil samples were also screened for radioactivity with a Victoreen Model 190 Radiation Monitor. Additional monitoring for the ESI included establishing a designated downwind monitoring station where monitoring for VOCs with an OVM and dust particulates using a Miniram was performed. The OVM was programmed to register real time and maximum readings of volatile organics. These meters were checked before drilling and at approximately 15 minute intervals during drilling.

Where proposed, three soil samples from each soil boring were selected for chemical analysis. These samples included the depths described below:

1. 0 to 2 feet below grade for the ESI program and 0 to 2 inches below grade for the RI program;
2. immediately above the water table; and
3. midway between samples (1) and (2).

The intermediate sample was collected at a depth where one of the following site specific items occurred:

- a stratigraphic change occurred such as the base of the fill,
- evidence of perched water table,
- elevated photoionization detection (PID) readings, or
- visibly affected soil (e.g., oil stains).

If none of these occurred, then the intermediate sample was collected at the halfway point between the samples collected at the surface and at the water table. If intermediate split-spoon samples exhibited elevated PID readings, the sample with the highest PID concentration was the intermediate sample selected for chemical analysis.

For the ESI field work, each of the soil samples was submitted for chemical testing for the following parameters:

- TCL volatile organic compounds,
- TCL semivolatiles,
- TCL pesticides/PCBs,
- herbicides by EPA Method 8150,
- TAL metals and cyanide according to NYSDEC CLP SOW,
- explosive compounds by EPA Method 8330,
- nitrates analyzed by EPA Method 352.2, and
- Total Recoverable Petroleum Hydrocarbons by EPA Method 418.1.

For the RI phase of the field work, each of the soil samples was submitted for chemical testing for the following parameters:

- TCL Volatile Organic Compounds,
- TCL semivolatile organic compounds;
- TCL pesticides/PCBs,
- TAL Metals and cyanide according to the NYSDEC CLP SOW,
- Explosive compounds by EPA Method 8330, and
- Nitrate-nitrogen by EPA Method 352.1.

Samples to be analyzed for volatile organic compounds were collected first in two 40 ml vials with septum seals; these soil samples were not homogenized or composited during the sampling process. The remaining soil from the spoon was mixed (homogenized) in a decontaminated stainless steel bowl with a decontaminated stainless steel utensil and placed in the appropriate sample containers.

During the RI phase of the work, soil samples were also collected and submitted for total organic carbon (TOC) and grain-size analyses. Soil samples were collected from both above, and below the water table. The grain size analysis was performed using ASTM method D:422-63 and included a determination of the particle size distribution of the silt and clay fraction [No. 200 (75mm) sieve] using a hydrometer. The results were plotted on a grain-size distribution curve.

All soil borings were logged using a standardized boring log form. Soil samples were classified according to the Unified Soil Classification System (USCS). In addition, a lithologic description was provided according to the Burmiester system.

Upon completion of sampling, all soil borings were either grouted to the ground surface or a monitoring well was installed at that particular location.. The soil brought to the surface by the augers was containerized in DOT-approved 55-gallon drums, which were labeled with the date, location, and description of wastes. The drilling rigs, augers and split-spoons were steam cleaned between borings at the decontamination pad.

2.2.4.2 Surface Soils

Grab samples of surface soils were obtained at SEAD-16 and SEAD-17 by removing representative sections of soil from 0 to 2 inches below ground surface (less organic matter). Vegetation was removed prior to sample collection.

During the ESI phase of the work, surface soil samples were collected with a stainless steel trowel or scoop, then placed in a stainless steel bowl. Soil samples destined for VOC analysis were placed in VOA vials before mixing the soil. The remaining sample soil was then homogenized and placed in the remaining sample containers. During the RI phase of the work, volatile organic samples of surface soils were collected by driving split spoons in order to collect core samples from a depth of 0 to 2 inches below ground surface. This change in the surface soil sampling procedure for the RI phase of the work was required due to regulatory comments provided to Parsons ES subsequent to the ESI phase of the work.

2.2.5 <u>Groundwater Investigation</u>

The ESI groundwater investigation program was designed to obtain background water quality data, to determine the groundwater flow direction, and to determine if the groundwater has been impacted by chemical constituents released from the sites.

The objective of the RI groundwater investigation program was to install monitoring wells that would provide representative samples of groundwater quality and accurate determinations of piezometric head in the overburden aquifer.

2.2.5.1 Monitoring Well Installation

Proper design, construction, and installation of the monitoring wells were essential for accurate interpretation of the groundwater data. The installation procedures were consistent with the USEPA Region II CERCLA QA Manual and the NYSDEC Technical and Administrative Guidance Manuals (TAGMS) regarding design, installation, development and collection of groundwater samples. Further, the programs were in compliance with all requirements described in the NYSDEC, 6 NYCRR Part 360, Solid Waste Management Facilities Regulations, Section 360-2.11, which details groundwater monitoring well requirements. The exception to compliance was that monitoring wells installed during the ESI field program were constructed of factory slotted PVC screens. For the RI program, monitoring wells were constructed of non-solvent welded/bonded continuous-slot, wire-wrap screens as required in 6NYCRR Part 360.

The overburden monitoring wells were installed using a hollow stem auger rig equipped with 4.25-inch hollow stem augers. The borings were advanced to auger refusal, which for the purposes of this investigation defined the contact between weathered shale and competent shale. During drilling, split-spoon samples were collected continuously until spoon refusal, using the method outlined in ASTM D-1580-84, to observe and characterize the soil conditions and geology at the well location. During the ESI, monitoring wells were constructed of 2-inch I.D. Schedule 40 polyvinyl chloride (PVC) with a well screen slot size of 0.010 inches. During the RI, the monitoring wells were constructed of 2-inch National Sanitation Foundation (NSF) or ASTM-approved schedule 40 PVC wire-wrapped screens as required by NYSDEC with threaded, flush joints that contain a rubber gasket. No solvents or other adhesives were used to connect the PVC casing. A silt sump "point" was placed at the bottom of each well.

All soil samples were screened for VOCs while in the split-spoon with an OVM 580B. During the ESI, the soil samples were also screened with a Dosimeter Min Con Rad for radioactivity. An MIE Model PDM-3 Miniram was also positioned on or near the drilling rig to detect dust. These meters were calibrated before drilling and checked approximately every 15 minutes during drilling.

During the ESI, a downwind monitoring station was also established during well installation. Each well location was monitored for VOCs with an OVM 580B and for particulates using a MIE Model PDM-3 Miniram. The OVM 580B was programmed to provide real time and maximum readings of volatile organics.

During the ESI, wells were screened from 3 feet above the water table (if space allowed) to the top of competent bedrock. Water table variations, site stratigraphy, and expected contaminant flow and behavior were also considered in determining the screen length and position. During the RI, the overburden monitoring wells had a maximum screen length of 10 feet and were screened across the water table and through the entire till/weathered shale aquifer, if possible.

Several methods for sizing sand pack materials and well screen openings are available in the literature. The methods are cited in Aller et al., (1989), Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells, Environmental Monitoring Systems Laboratory Office of Research and Development, U.S. Environmental Protection Agency, Las Vegas, Nevada, EPA 600/4-89/034, and Driscoll, F.G. (1988), Groundwater and Wells. Most methods are similar in concept and do not differ appreciably in their results. The first step in designing the filter pack is to obtain sieve analyses on the sample of the formation intended to be monitored. The filter pack material size is selected on the basis of the finest formation materials present.

The slot size for the monitoring wells had been determined and approved as part of an earlier RI at the Ash Landfill at SEDA. NYSDEC, USEPA, and the Army have reviewed the grain size curves for till and weathered shale from the OB Grounds at the SEDA as well as the documentation determining the proper screen size based on these curves. Given the types of formation materials (which were confirmed from visual soil classification at the OB Grounds, Ash Landfill, and 25 ESI sites in various locations at SEDA) the nature of their deposition, and their widespread distribution in the area, the till and weathered shale do not vary significantly across the base to preclude the use of these curves from the OB Grounds for slot size selection at SEAD-16 and SEAD-17. A 0.010-inch slot size used with a #3Q-ROC filter pack was determined to be appropriate for the monitoring wells on-site.

A sand pack was placed by pouring sand from the surface into the annular space between the well screen and the hollow stem auger. If the well was greater than 15 feet deep, a tremie pipe was used to place the sand pack. The sand pack was not extended more than 2 feet (but at least 6 inches) above the top, or 6 inches below the bottom of the screen. A finer grained sand pack material, 6 inches thick, was placed at the top of the sand pack, between the sand pack and the bentonite seal to prevent infiltration of the bentonite into the sand pack around the well screen.

A layer of bentonite pellets, between 1 and 2 feet thick, was used to seal the well and was poured within the annular space. During the RI phase of the work, potable water was poured on the pellets in a continuous stream for a period of one hour. Then, the remaining annular space was completely filled with a lean cement grout containing at least 3% by weight bentonite to cement. The grout mixture was placed in the annular space by pouring or pumping it from the surface. In some instances, the bentonite extended to the surface if there was no vertical space available for a cement/bentonite grout.

In all instances, wells were protected with a steel casing, at least 4 inches in diameter. This protective steel casing extended 3 1/2 feet below the ground surface to prevent heaving by frost. In some cases, the depth of the protective casing was reduced to allow for better well construction in shallow bedrock situations. However, in this instance the casing was shortened so that no more than 2.5 feet stick up above the ground surface. The protective casing had a locking cap and a brass, weather resistant padlock. A cement collar was placed around each well. A weep hole was drilled at the base of the protective steel casing above the cement collar to allow drainage of water. A locking expandable cap was also placed in the top of the PVC well casing. To allow the water in the well to equilibrate when the expandable cap is tightened, a small slot was cut in the PVC well pipe 1-inch below the base of the expandable well cap. A permanent well identification number was stamped into the steel protective casing.

2.2.5.2 Monitoring Well Development

Subsequent to the well installations, each monitoring well was developed to insure that a proper hydraulic connection existed between the well and the surrounding aquifer. The development of monitoring wells was performed 2 to 7 days after well installation and at least 7 days before well sampling and water elevation activities.

Because some wells were slow to recharge due to the low permeability of the formation, surging and overpumping was required to be performed numerous times on each well, with complete recharge between each episode. Every attempt was made to remove excessive turbidity from the wells. In some instances, a lack of water in the aquifer (especially during, the late summer and early fall) hampered well developed.

Development Criteria

Each monitoring well was developed to ensure the collection of representative groundwater samples. The criteria for determining if the well had been properly developed was based upon the guidance provided by the NYSDEC, TAGM #HWR-88-4015. This guidance document specifies a maximum allowable turbidity level in groundwater samples collected from monitoring wells.

The development procedure consisted of light surging for 2 to 5 minutes, with periodic removal of water using a bailer. During the RI phase, surging was performed with a surge block that had a diameter slightly smaller than the well diameter. During the ESI, surging was performed with a bailer. The light surging was performed to remove any silt and clay "skin" that may have formed on the borehole wall during drilling. After surging, the water in the well was removed using a peristaltic pump at a rate of between 1.5 and 3 liters per minute. At the end of the development process, the water was removed at a minimum rate of 0.1 liter per minute. This low flow allowed the well and the surrounding formation to be developed while not creating a large influx of silt and clay.

During well development, temperature, specific conductivity and pH were measured in the field. A Hach portable field turbidmeter with full scale ranges of 1.0, 10, and 100 NTUs was used to measure turbidity. Readings were conducted for each well volume. Development operations were performed until the following primary conditions were met:

1. Water samples had the lowest possible turbidity measurement (preferably < 50 NTUs); and
2. The temperature, specific conductivity and pH of the water varied by no more than 10 percent over 2 consecutive readings.

In addition to meeting the above primary conditions, at least three borehole volumes of water were removed from the well, if the well allowed. If not, as much water as was necessary to meet the primary conditions was removed. In all instances at least one well volume was removed.

2.2.5.3 Groundwater Sampling

ESI Program Methodology

During the ESI phase of the work, the monitoring wells were purged prior to sampling using a peristaltic pump and dedicated Teflon tubing that extended to the bottom of the well. A low-flow purging method was implemented to collect groundwater samples with the lowest possible turbidity.

Prior to purging, the thickness of the silt layer at the bottom of the well was determined by measuring the depth to the top of the silt and subtracting that from the depth of the well. If the thickness of the silt was greater than 1 inch, then the silt was removed using the peristaltic pump and dedicated Teflon tubing. Silt removal was complete when the water was no longer silt-laden and dark brown-gray in color.

The purging process began with the open-end of the tube at the bottom of the well screen, or at least 6 inches from the bottom of the well. The purging flow rate was between 0.01 and 2 liters per minute (L/min), and the water was collected at the surface with a graduated 5-gallon bucket. During the purging process, the water level in the well was monitored with an electronic water level meter. The water was not pumped below one half of the pre-purge static water column height. During removal of the first volume of water, it was determined if the well was a slow or fast recharging well. A fast recharging well supplies water to the well such that the water level is not drawn below the depth of one half of the static height of the water column using flow rates between 0.01 and 2 L/min. A slow recharging well does not supply water to the well to maintain a water level at or above one half of the static height of the water in the well using a minimum purge rate of 0.01 L/min.

For wells that were slow to recharge, purging continued until approximately one-half the well volume had been removed or the water level in the well reached the depth of one half the static height of the water column. At this time, the indicator parameters (temperature, specific conductivity, and pH) were measured and the time, flow rate, depth to the bottom of the opening of the Teflon tube, and total volume of water removed were recorded on the sampling data sheet. The Teflon tube was slowly raised to a point between the top of the well screen and the water surface. If this was not feasible, the open end of the tube was raised to the highest point possible to allow water to be pumped.

If during purging, the water level was lowered to below one half of the static water column height then the pump was shut off and the well was allowed to recharge before continuing. After one well volume had been removed, the indicator parameters were measured and the time, flow rate, depths, and volume of water removed were recorded. If at least one well volume had been removed and the measurements of temperature, specific conductance, and pH had stabilized (i.e., two successive measurements varied be less than 10 percent), then purging stopped. If they had not stabilized, then purging continued until they stabilized. At this time, the well was considered to have been purged enough to ensure that the subsequent water samples collected from the well would be representative of water from the aquifer. After stabilization, the water level in the well was monitored periodically, for a period of 3 hours. During this time, if the well had recovered to 95 percent of the original static level, then of the well was sampled. If the 95 percent recovery was not achieved after 3 hours, the recovery requirement for the well was reduced to 85 percent prior to sampling. If the well had not recharged to 85 percent after 6 hours, sampling of the well began.

The following procedure was used for purging a fast recharging well. After approximately one well volume was removed, the time, flow rate, depth to the bottom of the opening of the Teflon tube and the total volume of water removed was recorded on the sampling data sheet. Measurements of indicator parameters (temperature, specific conductance and pH) were also made this time. The Teflon tube was slowly raised to a point between the top of the well screen and the water surface. After each well volume was removed the indicator parameters were measured and recorded. Purging of the well continued until three well volumes were removed. After purging the third well volume, the indicator parameters were recorded for the last time. If required, additional temperature, specific conductance, and pH measurements were made until they stabilized (two successive measurements varied by less than 10 percent). Moving the location of the tube from the screened interval to a point near the top of the water surface during purging ensured the removal of any stagnant water from the well prior to sampling. After removal of three well volumes the water level in the well was periodically measured. During this time, if the well had recovered to 95 percent of the original static level, then the well was sampled. If the 95 percent recovery was not achieved after 3 hours, then the recovery requirement for the well was reduced to 85 percent prior to sampling.

Before collecting the sample, the Teflon purging tube was removed from the well and placed into a clean plastic bag. To sample, a bailer was lowered into the well at a rate of approximately 1/2-inch per second to minimize the disturbance of water and silt in the well. When the bailer was filled with water it was removed at a rate of approximately 1/2-inch per second and the appropriate sample containers were filled. If the well was bailed to near dryness during the sampling process (i.e., the bailer reaches the bottom of the well), sampling was stopped until the well recharged to 85 percent of the original static level. If it did not recharge to 85 percent after 6 hours, sampling continued as water was available for each parameter. When sampling was complete, the dedicated Teflon tubing was returned to the well.

During the ESI phase of the work, groundwater samples were analyzed for the following parameters:

- Target Compound List (TCL) for Volatile Organic Compounds by NYSDEC CLP,
- TCL for Semivolatiles,
- TCL for Pesticides and PCBs;
- Target Analyte List (TAL) for metals and cyanide,
- herbicides by EPA Method 8150, and
- Total Recoverable Petroleum Hydrocarbons by EPA Method 418.1, and nitrates by EPA Method 353.2.

The sampling order was as follows:

- volatile organic compounds,
- semivolatile organic compounds,
- metals,
- cyanide,
- pesticides and PCBs,
- herbicides,
- Total Recovered Petroleum Hydrocarbons (TRPH), and
- nitrates.

The sampling order allowed that metals were collected early in the sequence. Obtaining low turbidity water samples for metals that are truly representative of the aquifer was a primary goal of the sampling procedure. Therefore, water for metals analysis was collected early in the sequence, because water collected late in the sequence using a bailer tends to be more turbid.

RI Program Methodology

During the RI phase of the work, the groundwater sampling procedures for monitoring wells and microwells were conducted according to the Draft SOP titled Groundwater Sampling Procedure, Low Flow Pump Purging and Sampling (EPA, May 15, 1995). This method produced groundwater samples with significantly lower turbidities than those for the ESI.

A Marschalk bladder pump, which is a low-flow pump constructed of stainless steel, and Teflon tubing were used to purge and sample the monitoring wells.

Both the static water level and the water level after the pump was submerged were measured before purging commenced at a well.. Pumping of the well was started at 200 to 500 milliliters per minute. Following the Draft SOP the pumping rate was set to cause little or no water level drawdown in the well (less than 0.3 ft. with the water level stabilized). The water level was monitored every three to five minutes (or as appropriate) during pumping. Care was taken not to cause pump suction to be broken, or entrainment of air in the sample. Any pumping rate adjustments and the depth to the water were recorded throughout the process.

Pumping rates were, as needed, reduced to the minimum capabilities of the pump to avoid pumping the well dry. If the recharge rate of the well was very low, purging was interrupted so that the water level within the well did not drop below the pump. A steady flow rate was maintained to the extent practicable. Sampling commenced as soon as the volume in the well had recovered sufficiently to permit collection of samples. In some very low-yielding formations it was not possible to sample with minimal drawdown even using the lowest pumping rates.

During purging of the well, field indicator parameters (turbidity, temperature, specific conductance, pH, DO, and Eh) were monitored every three to five minutes. The well was considered stabilized and ready for sampling once all the field indicator parameter values reached stabilization. Stabilization is considered to be achieved when three consecutive readings, taken at three to five minute intervals, are within the following limits:

- turbidity (10% for values greater than 1 NTU)
- DO (10%)
- specific conductance (3%)
- temperature (3%)
- pH (± 0.1 unit)
- ORP/Eh (± 10 millvolts)

The variability within each water quality indicator parameter is based on the current recommendations of the EPA Office of Research and Development, which have been adopted by EPA Region II. If the parameters had stabilized, but the turbidity was not below the 50 NTU goal, the pump flow rate was decreased to no more than 100 ml/min. Measurement of the indicator parameters for DO, Eh specific conductance, temperature, and pH were obtained using a flow through cell (Hydrolab H20 water quality meter), which kept the sample from being exposed to the air prior to measurement. Turbidity was measured in a clean container using a portable turbidity meter, such as a glass beaker. The order of equilibration for each water quality indicator parameter should be pH, temperature, and specific conductance, followed by oxidation-reduction potential, dissolved oxygen and turbidity. However, it should be noted that temperature and pH, while often used as equilibration indicators are actually quite insensitive in terms of distinguishing between formation water and stagnant casing water.

Groundwater samples were collected for volatile analyses first. The actual sampling flow rate for volatiles was accomplished with a gradual reduction in the flow rate down to 100 milliliters per minute and sustained hudraulic head pressure within the sampling tube. A gradual reduction in association with sustained hydraulic head pressure minimized aeration, bubble formation, turbulent filling of sample bottles, and loss of volatiles due to extended residence time in the tubing. This method coincides with the USEPA Region II Quality Assurance Manual (October 1989) and the RCRA Groundwater Monitoring Technical Enforcement Guidance Document (OSWER Directive #9950.1, September 1986), which state that when collecting samples where volatile constituents are of concern using a bladder pump, pumping rates should not exceed 100 milliliters per minute.

The sample discharge for all other analytical parameters was a continuous flow of up to 500 milliliters per minute.

The groundwater sampling order was as follows:

- volatile organic compounds,
- semivolatile organic compounds,
- metals,
- cyanide,
- pesticides and PCBs,
- TRPH,
- Explosives, and
- Nitrate-nitrogen.

As each sample was collected, the sample was labeled. All samples requiring cooling were placed into an ice-filled cooler maintained at 4°C for delivery to the laboratory.

All sample containers were filled by allowing the pump discharge to flow slowly down the inside of the container with minimal turbulence. The groundwater samples were analyzed for the following parameters:

- Volatile organic compounds by EPA Mehtod 524.2,
- TCL semivolatile organic compounds,
- TCL pesticides/PCBs,
- TAL metals and cyanide according the NYSDEC CLP SOW,
- Total Recoverable Petroleum Hydrocarbons (TRPH),
- Explosives, and
- Nitrate-nitrogen.

Purging and sampling equipment, which consisted of the bladder pump, was decontaminated prior to being used at each well. The pump was partially disassembled and flushed with the decontaminating solutions. The procedure was as follows:

1. Flush with potable water.
2. Flush with non-phosphate detergent solution.
3. Flush with tap water to remove the detergent.
4. Flush with distilled/dionized water.
5. Flush with isopropyl alcohol.
6. Flush with distilled/dionized water.

2.2.6 Aquifer Testing Investigation

2.2.6.1 Groundwater Level Measurements

During the ESI at SEAD-16 and SEAD-17, one round of water level measurements was completed on April 4, 1994. For the RI, three rounds of water level measurements were completed for all monitoring wells at SEAD-16 and SEAD-17. Two of these RI rounds (August 27, 1996 and December 6, 1996) were used to determine groundwater flow directions at the sites.

Each round of water level measurements was conducted within a 10-hour period so that they represented a "snap-shot" of groundwater conditions at the sites. The water levels were measured to the nearest one hundredth of a foot using a battery-operated water level indicator. All groundwater depth measurements were referenced to a notch on the top of the well casing (PVC). Water level measurement equipment, including the water level indicator, was decontaminated before it was used at any monitoring wells.

2.2.6.2 Rising Head Slug Testing

During the RI phase of the work, the hydraulic conductivity of the overburden aquifer was determined using the rising head slug test method at SEAD-16 and SEAD-17. The rising head test requires the instantaneous removal of a specific volume of water from the well resulting in a lowering of the water table in the well. Subsequent to the removal of the volume, rising water levels were recorded over time for later data reduction and hydraulic conductivity calculations.

Prior to the beginning the test, the water level in the well was measured using an electronic water level meter. Then an In-Situ, Inc. model PTX-161 pressure transducer rated to 10 pounds per square inch (psi) was lowered into the well to an appropriate depth so that when the slug was lowered into the well it would not come in contact with the transducer. At least one foot was allowed between the bottom of the well and the transducer. Next, either a 3-foot or 5-foot long stainless steel slug with a 1.66-inch diameter was lowered into the well using clean nylon rope so that the top of the slug was just below the static water level previously measured in the well. The hollow stainless steel slug contained machined ends onto which stainless screw caps with o-ring gaskets fit. The slug was filled with potable water for the test. After the slug was lowered into the well, the water level in the well was allowed to equilibrate. Water levels were measured until they stabilized to within 0.01 feet for 5 minutes by monitoring the transducer via the data logger. The stabilized water level at the end of the test was nearly equal to the original static water level.

After stabilization of the water level, the slug was quickly removed and data logger started simultaneously thereby beginning the slug test. A 2-channel Hermit model 1000C data logger was used to record the slug test data. The data logger was configured for logarithmic data collection so that early time water level changes could be adequately recorded. After 10 minutes of data collection the water level was monitored with the data logger to determine if it had stabilized. When the water level reached 80 percent of the original static water level and stabilized to 0.02 feet over a 5-minute time period, the test was stopped. The test data was downloaded to a portable computer in the field and reviewed to evaluate whether the data was acceptable.

In instances where the saturated thickness of the aquifer was small enough such that it did not allow significanct displacement of water with a transducer/slug configuration, a stop watch and water level meter were used to measure and record the depth to water data. In these instances, the slug was placed at the bottom of the well to maximize the volume of water displaced during the test.

The slug test information for each monitoring well was reduced using the procedure described by Bouwer and Rice (1976 and 1989). Normalized recovery rates were plotted against time on a semi-logarithmic plot and the hydraulic conductivity was determined by the computer program AQTESOLV Version 1.1 Release 4. Prior to running the program the time and water level data was imported into an AQTESOLV data file. Next, input data required for analyzing the slug test was entered. The input data consisted of the following: 1) initial drawdown in test well; 2) internal radius of the test well casing; 3) effective radius of the test well; 4) saturated aquifer thickness under static conditions; 5) length of the test well screen; and 6) height of water column in test well under static conditions. Once the data were plotted, the hydraulic conductivity was determined using the automatic iterative estimating and interactive on-screen curve matching capabilities of the program to match the straight line portion of the drawdown (displacement) curve.

Recent refinements have been developed in the interpretation of slug test data in unconfined formations using the Bouwer and Rice (1976 and 1989) Method (i.e., Zlotnik, V., 1994, Groundwater, V.32, No. 5, and more recently, Hyder, Z. and Butler, J.J. Jr., 1995, Groundwater V. 33 No. 1). In response to this, the method for interpreting slug test data using the Bouwer and Rice (1976 and 1989) technique was modified to include, where appropriate, the recommendations of Zlotnik (1994). In instances where there was no significant vertical flow affecting the test according to the geometric criteria stated by Zlotnik (i.e., $L/D \approx 1$) this method was not used. Because all of the overburden wells installed in the till were screened across all or most of the aquifer saturated thickness, the criteria for test geometry ($L/D \approx 1$) held true in most instances.

2.2.7 Surface Water and Sediment Investigations

Surface water samples were collected at both sites by immersing a clean glass beaker or a sample bottle without preservatives into the surface water body. The sample was then transferred to a pre-preserved sample bottle, if required. Temperature, conductivity, and pH and dissolved oxygen of surface water were measured directly in the field with calibrated meters. pH was measured with an Orion pH meter, Model SA230 or SA230A. Conductivity and temperature were measured with a YSI Model 33 conductivity meter.

Sediment samples were collected by scooping sediment into a decontaminated stainless steel bowl with a decontaminated trowel. Volatile organic samples were taken first, prior to any mixing of the sediments. Then, the bowl was refilled with additional sediment, if required, thoroughly mixed and the additional sample containers filled with sediment. Samples were then placed in chilled coolers prior to shipment to the laboratory.

During the ESI phase of the program, surface water and sediment samples were analyzed for the following parameters:

- TCL volatile organic compounds,
- TCL semivolatile organic compounds,
- TCL pesticides/PCBs,
- TAL metals and cyanide,
- explosive compounds,
- herbicides, and
- nitrate.

During the RI phase of the program, surface water and sediment samples were analyzed for the following parameters:

- TCL volatile organic compounds,
- TCL semivolatile organic compounds,
- TCL pesticides/PCBs,
- TAL metals and cyanide,
- explosive compounds, and
- nitrate-nitrogen.

In addition, the surface water samples were also analyzed for hardness, TOC, and pH, and the sediment samples were analyzed for TOC and grain size distribution including the distribution within the silt and clay fractions.

2.2.8 Ecological Investigation

The following procedure for the ecological investigation was developed from the New York State Department of Environmental Conservation (NYSDEC) Fish and Wildlife Impact Analysis (FWIA) for Inactive Hazardous Waste Sites (1994). The ecological assessment followed the requirements outlined as Step I and Step IIA of the FWIA. The purpose of the ecological investigation was to determine if aquatic and terrestrial resources have been affected by a release of contaminants from the sites. The investigation was completed in two parts. The first part was the site description, which involved the accumulation of data describing the physical characteristics of the sites, as well as the identification of aquatic and terrestrial resources present or expected to be present at the sites. The second part was the contaminant-specific impact analysis, which involved the determination of whether the identified aquatic and terrestrial resources have been impacted by contaminants that have been released at the sites. The second part of the ecological investigation was dependent upon the chemical analysis data obtained for the RI.

2.2.8.1 Site Description

The purpose of the site description was to determine whether aquatic and terrestrial resources are present at the sites and if they were present at the sites prior to the chemical impacts. The information gathered included site maps, descriptions of aquatic and terrestrial resources at the site, the assessment of the value of the aquatic and terrestrial resources, and the appropriate contaminant-specific and site-specific regulatory criteria applicable to the remediation of the identified aquatic and terrestrial resources.

A topographic map showing the sites and documented aquatic and terrestrial resources within a two-mile radius from each site was obtained. The aquatic and terrestrial resources of concern are: 1) Significant Habitats as defined by the New York State Natural Heritage Program; 2) habitats supporting endangered, threatened or rare species or species of concern; 3) regulated wetlands; 4) wild and scenic rivers; 5) significant coastal zones; streams; 6) lakes; and, other major resources.

A map showing the major vegetative communities within a one-half mile radius of each site was also developed. The major vegetative communities include wetlands, aquatic habitats, NYSDEC Significant Habitats, and areas of special concern. These covertypes were identified using the NYSDEC Natural Heritage Program descriptions and classifications of natural communities.

To describe the covertypes at each site, the abundance, distribution, and density of the typical vegetative species were identified. To describe the aquatic habitats at the sites, the abundance and distribution of aquatic vegetation were identified.

The aquatic and terrestrial species that are expected to be associated with each covertype and aquatic habitat were determined. In particular, endangered, threatened and rare species, as well as species of concern, were identified. Alterations in biota, such as reduced vegetation growth or quality were described. Alterations in, or absence of, the expected distribution or assemblages of wildlife were described.

A qualitative assessment was conducted evaluating the ability of the area within a one-half mile of the site to provide a habitat for aquatic and terrestrial species. The factors that were considered included the species' food requirements and the seasonal cover, bedding sites, breeding sites and roosting sites that the habitats provide.

The current and potential human use of the aquatic and terrestrial resources of the sites and the area within a one-half mile of the site were assessed. In addition to assessing this area, documented resources within two miles of the site and downstream of the site that might be potentially affected by contaminants were also assessed. Human use of the resources that were considered includes activities such as hunting, fishing, wildlife observation, scientific studies, agriculture, forestry, and other recreational and economic activities.

The appropriate regulatory criteria were identified for the remediation of aquatic and terrestrial resources and included site-specific, contaminant-specific and action-specific criteria.

2.2.8.2 Contaminant-Specific Impact Analysis

Information from the site description developed in the previous section and from the characterization of the chemicals impacts the site developed from the results of the RI were used to assess the impacts of these chemicals on aquatic and terrestrial resources. The impact analysis involved three steps, each using progressively more specific information and fewer conservative assumptions and depended upon the conclusion reached at the previous step regarding the degree of impact. If minimal impact was demonstrated at a specific step, additional steps were not conducted.

Pathway Analysis

A pathway analysis was performed identifying aquatic and terrestrial resources, contaminants of concern and potential pathways of contaminant migration and exposure. After performing the pathway analysis, if no significant resources or potential pathways were present, or if results from field studies showed that chemicals have not migrated to a resource along a potential pathway, the impact on aquatic and terrestrial resources was considered to be minimal and additional impact analyses were not performed.

Criteria-Specific Analysis

Presuming that the presence of chemical resources and pathways of migration of site-related chemical impacts had been established, the chemicals levels identified in the field investigation were compared with available numerical criteria or criteria developed according to methods established as part of the criteria. If chemicals levels were below criteria, the impact on resources were considered to be minimal and additional impact analyses were not performed. If numerical criteria were exceeded or if they did not exist and could not be developed, an analysis of the toxicological effects was performed.

Analysis of Toxicological Effects

The analysis of toxicological effects was based on the assumption that the presence of chemicals resources and pathways of migration of site-related chemicals had been established. The purpose of the analysis of toxicological effects was to assess the degree to which chemicals have affected the productivity of a population, a community, or an ecosystem and the diversity of species assemblages, species communities or an entire ecosystem through direct toxicological and indirect ecological effects. A number of approaches were available to conduct an analysis of toxicological effects. One or more of the four following approaches was used to assess the toxicological effects.

- Indicator Species Analysis–A toxicological analysis for a indicator species was used if the ecology of the resource and the exposure scenarios were simple. This approach assumes that exposure to chemicals is continuous throughout the entire life cycle and does not vary among individuals.
- Population Analysis–A population level analysis was relevant to and was used for the evaluation of chronic toxicological effects of chemicals to an entire population or to the acute toxicological effect of chemical exposure limited to specific classes of organisms within a population.
- Community Analysis–A community with highly interdependent species including highly specialized predators, highly competitive species, or communities whose composition and diversity is dependent on a key-stone species, was analyzed for alternations in diversity due to chemical exposure.
- Ecosystem Analysis–If chemicals are expected to uniformly affect physiological processes that are associated with energy transformation within a specific trophic level, an analysis of the effects of chemical exposure on trophic structure and trophic function within an ecosystem was performed. Bioconcentration, bioaccumulation, biomagnification, etc., are concepts that may be used to evaluate the potential effects of chemical transfer on trophic dynamics.

2.3 SEAD-16: ABANDONED DEACTIVATION FURNACE (Buildings S-311 and 366)

2.3.1 Introduction

The following field investigations were performed to complete the ESI and RI characterization of SEAD-16:

- Site Surveying Program
- Geophysical Investigation,
- Building Investigation
- Soil investigation,
- Groundwater investigation,
- Surface water/sediment investigation, and
- Ecological investigation.

2.3.2 Site Survey Program

Two site survey programs were conducted at SEAD-16: one during the ESI phase and one during the RI phase of the investigation.

The site survey program conducted during ESI phase consisted of field reconnaissance, ground control, aerial photogrammetry, and a field survey to identifiy the location and elevation of monitoring wells, soil borings, and all other sampling points. A reconnaissance of the site was performed to locate general site features and confirm the presence of significant features (i.e., debris pits, monitoring wells, access roads) identified in the Ten SWMU ESI workplan. Sample locations were also identified and marked during this initial survey. The site and surrounding area was photographed from the air on December 14, 1993 for the purpose of constructing a photogrammetric site plan with 2-foot contour intervals. This photogrammetric map was used as the basis for the site base map (Figure 1-3). The photographs were also utilized during the ecological survey to identify significant vegetative types. Ground control for the photogrametric survey was performed during the months of November 1993 through February 1994. During the field survey all sampling locations and monitoring wells were located and surveyed. At each monitoring well location, the top of the PVC riser pipe, protective steel casing and the ground surface elevation at each well location were surveyed. Each location was referenced to the New York State Plane Coordinate System.

During the RI phase, a site reconnaissance was also performed. The RI survey included soil borings, surface soil locations, monitoring wells (new and existing), and all surface water/sediment sampling points.

2.3.3 Geophysical Investigation

Four seismic refraction profiles (P1, P2, P3 and P4) each 115-feet long, were performed during the ESI (Figure 2-1). Data from the surveys were used to estimate the direction of groundwater flow. The results of the seismic survey were used to adjust the locations of the monitoring wells in order to locate wells upgradient and downgradient of the pad.

2.3.4 Building Investigation

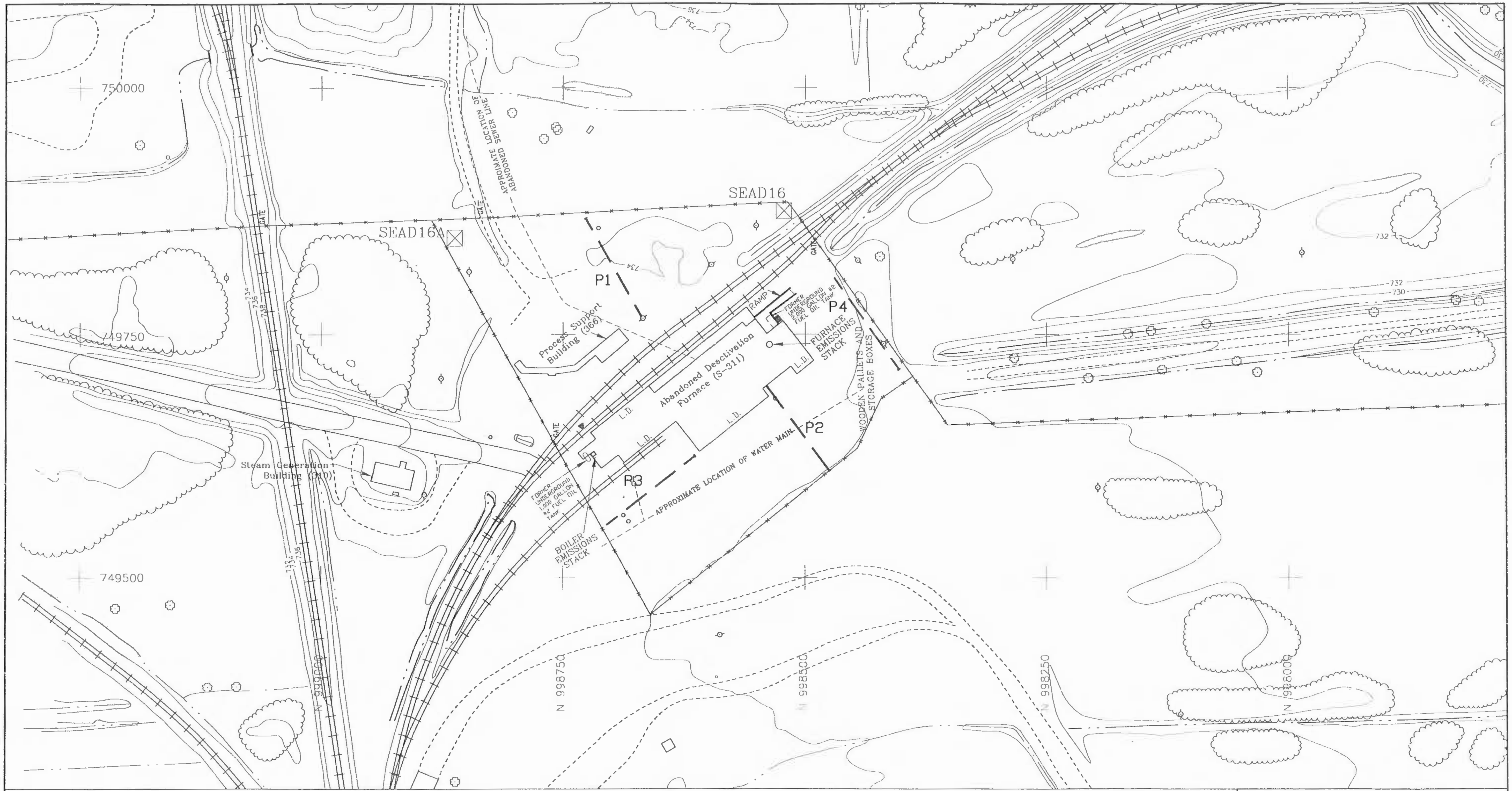
2.3.4.1 Investigation of the Abandoned Deactivation Furnace (Building S-311)

ESI Field Investigation

Building S-311, the Abandoned Deactivated Furnace was investigated during the ESI at SEAD-16. This investigation consisted of a visual inspection of the building for the presence of waste materials and sampling and analysis of building materials and wastes present. Sampling was conducted to determine whether hazardous materials were present within the building that may pose a threat to human health and the environment. This investigation was also performed to assess whether a removal action would be warranted if an imminent hazard or threat were present.

During the building inspection and investigation, miscellaneous wastes and potentially contaminated building materials were identified in several areas of the building. The building is in poor condition and of standing water was noted in the basement level. Wastes which were present included soil piles and soil/sludge covering concrete floors, shell casings, filter drums, ash residues in the furnace area and miscellaneous construction debris.

A total of 24 asbestos and floor samples were collected at 18 locations from within Building S-311 during the ESI field investigation. These samples were collected on December 6, 1993 (Table 2-1). Eight samples of building materials, two samples of furnace scale, and six samples of soil from inside the building were analyzed for asbestos (Figure 2-2). Eight samples of material from the



LEGEND

ACAD\SENECA\16-17RIF\SD16GEO.DWG

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CLIENT/PROJECT TITLE

SENECA ARMY DEPOT ACTIVITY
RI/FS
SEAD-16 ABANDONED DEACTIVATION FURNACE

DEPT	Dwg No.
ENVIRONMETAL ENGINEERING	729895-01001

FIGURE 2-1
SEAD-16 LOCATION OF GEOPHYSICAL SURVEYS

SCALE	DATE	REV
1" = 100'	DECEMBER 1996	A

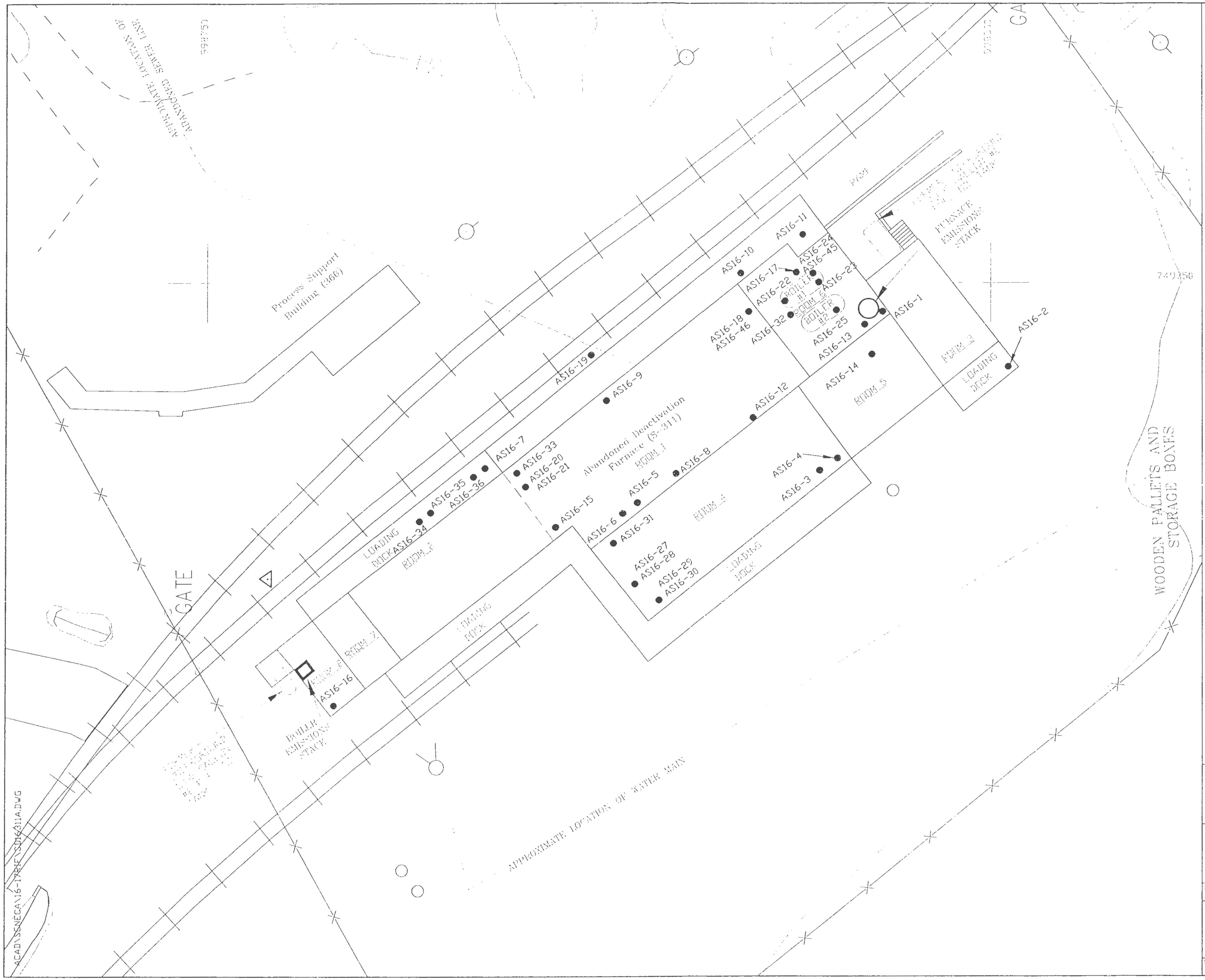
Table 2-1

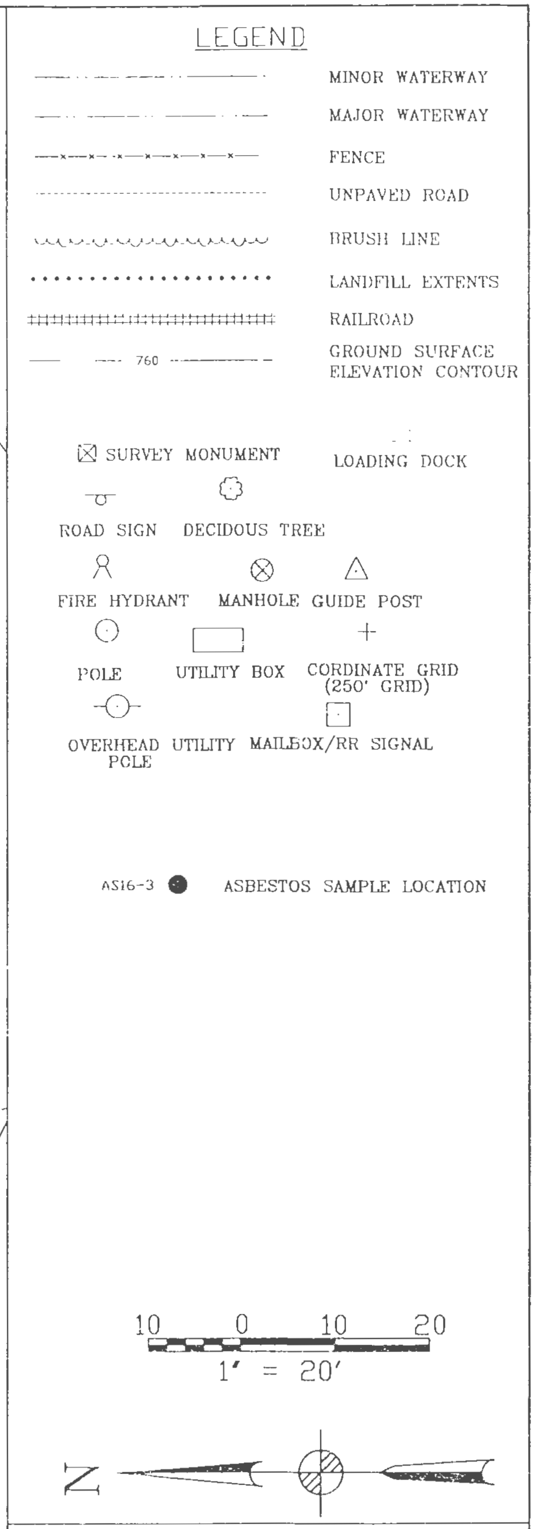
SEAD-16 - Solid Materials Sampling Summary
Samples from Building S-311

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Asbestos Sample Number	Floor Sample Number	Date Collected	Room Location	Material Description
AS-16-1	NS	12/06/93	Room 6	Pipe insulation
AS-16-2	NS	12/06/93	Loading Dock	Sheetrock (2 layers)
AS-16-3	NS	12/06/93	Room 4	Pipe insulation
AS-16-4	NS	12/06/93	Room 4	Sheet rock
AS-16-5	NS	12/06/93	hallway	Transite
AS-16-6	NS	12/06/93	hallway	Duplicate of #5
AS-16-7	NS	12/06/93	Platform	Roofing debris
AS-16-8	FS-16-4	12/06/93	hallway	Soils
AS-16-9	FS-16-3	12/06/93	Room 1	Soils
AS-16-10	NS	12/06/93	Room 3	Furnace packing (scale)
AS-16-11	NS	12/06/93	Room 3	Stack mesh coating (scale)
AS-16-12	NS	12/06/93	Hallway	Building debris
AS-16-13	FS-16-6	12/06/93	Room 5	Soils
AS-16-14	FS-16-5	12/06/93	Room 5	Soils
AS-16-15	FS-16-7	12/06/93	Room 1	Soils
AS-16-16	FS-16-8	12/06/93	Room 8	Soils
NS	FS-16-1	12/06/93	Room 3	Soils
NS	FS-16-2	12/06/93	Room 6	Soils
AS-16-17	NS	08/08/96	Room 6	Roof material
AS-16-18	NS	08/08/96	Room 1	Roof material
AS-16-19	NS	08/08/96	Loading Dock	Material from Wall adjacent to pipe run
AS-16-20	NS	08/08/96	Room 1	Ceiling
AS-16-21	NS	08/08/96	Room 1	Ceiling
AS-16-22	NS	08/08/96	Room 6	Boiler #2
AS-16-23	NS	08/08/96	Room 6	Boiler #2
AS-16-24	NS	08/08/96	Room 6	Boiler #2
AS-16-25	NS	08/08/96	Room 6	Boiler #1
AS-16-27	NS	08/08/96	Room 4	Cardboard box
AS-16-28	NS	08/08/96	Room 4	Cardboard box
AS-16-29	NS	08/08/96	Room 4	Wooden Crate/Broken up floor tiles
AS-16-30	NS	08/08/96	Room 4	Wooden Crate/Broken up floor tiles
AS-16-31	NS	08/08/96	Room 4	Paint
AS-16-32	NS	08/08/96	Room 6	Boiler # 2 from Side
AS-16-33	NS	08/08/96	Room 1	Paint Sample
AS-16-34	NS	08/08/96	Loading Dock	Paint Sample from exterior wall
AS-16-35	NS	08/08/96	Loading Dock	Plaster Panel Debris
AS-16-36	NS	08/08/96	Loading Dock	Plaster Panel Debris

Notes: (1) AS samples were analyzed for asbestos only. FS samples were analyzed for volatile organics, semivolatile organics, pesticides/PCBs, metals, cyanide, explosives, and nitrate-nitrogen.
(2) NS = Not sampled.





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SEAD-16 ABANDONED DEACTIVATION FURNACE

ENVIRONMETAL ENGINEERING | 729895-01001

FIGURE 2-2
SEAD-16 LOCATION OF ASBESTOS SAMPLES IN BUILDING S-311

1" = 20' | DECEMBER 1996 | A

floor of the building were analyzed for the chemical analyses described in Section 2.2.4.1 (Figure 2-3). Asbestos samples were identified as AS, and floor samples that collected for chemical analysis were identified as FS. At six locations, samples were collected for both asbestos and chemical analyses. Table 2-1 lists the samples that were collected and material descriptions.

Two standing water samples (SW16-1 and SW16-2) were collected from the standing water in the southeastern end of Building S-311 (Figure 2-3).

RI Field Investigation

Material and air samples were collected in and around building S-311 as part of the RI field investigation. The types and number of samples are described below.

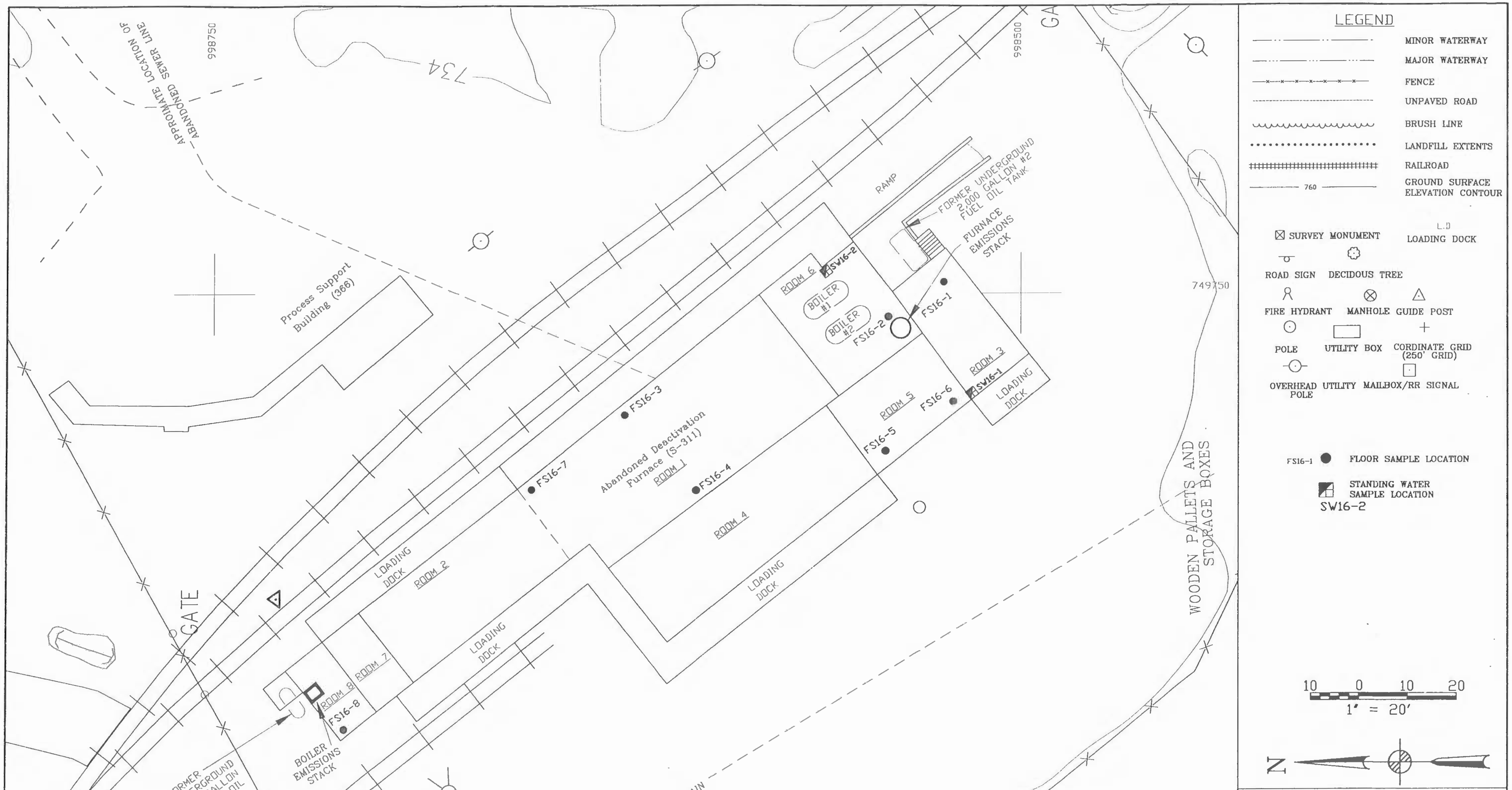
Material Sampling

A total of 19 material samples were collected from within Building S-311 during the RI field investigation and all of the samples were analyzed for asbestos. These samples were collected on August 8, 1996. The locations of the samples are shown in Figure 2-2 and the samples and material descriptions are presented in Table 2-1.

Air Samples

To evaluate risks from the building as part of the baseline risk assessment, air samples were collected at a total of three locations. Two of the locations were located inside building S-311 (S-311NERI and 5-311SWR4) and the last one (S-311BKGRD) was located outside the building, in a background location (Figure 2-4). These samples were collected to asses the inhalation exposure pathway from asbestos, metals, and SVOCs. Because each of these target compound categories requires a different sampling methodology, a total of four (4) separate sampling systems representing asbestos, metals (excluding mercury), mercury, and SVOCs were employed at each sampling location. In addition, for quality assurance purposes, a second set of sampling systems for the collection of colocated samples (i.e., field duplicates) was also employed at the indoor location nearest to boilers No. 1 and 2 in Room 6. In total, this air sampling event generated 16 samples, four each for asbestos, metals, mercury, and SVOCs.

Multiple individual compounds were quantified within the two broad target compound categories of metals and SVOCs. The metal samples were analyzed for the 22 individual metals specified



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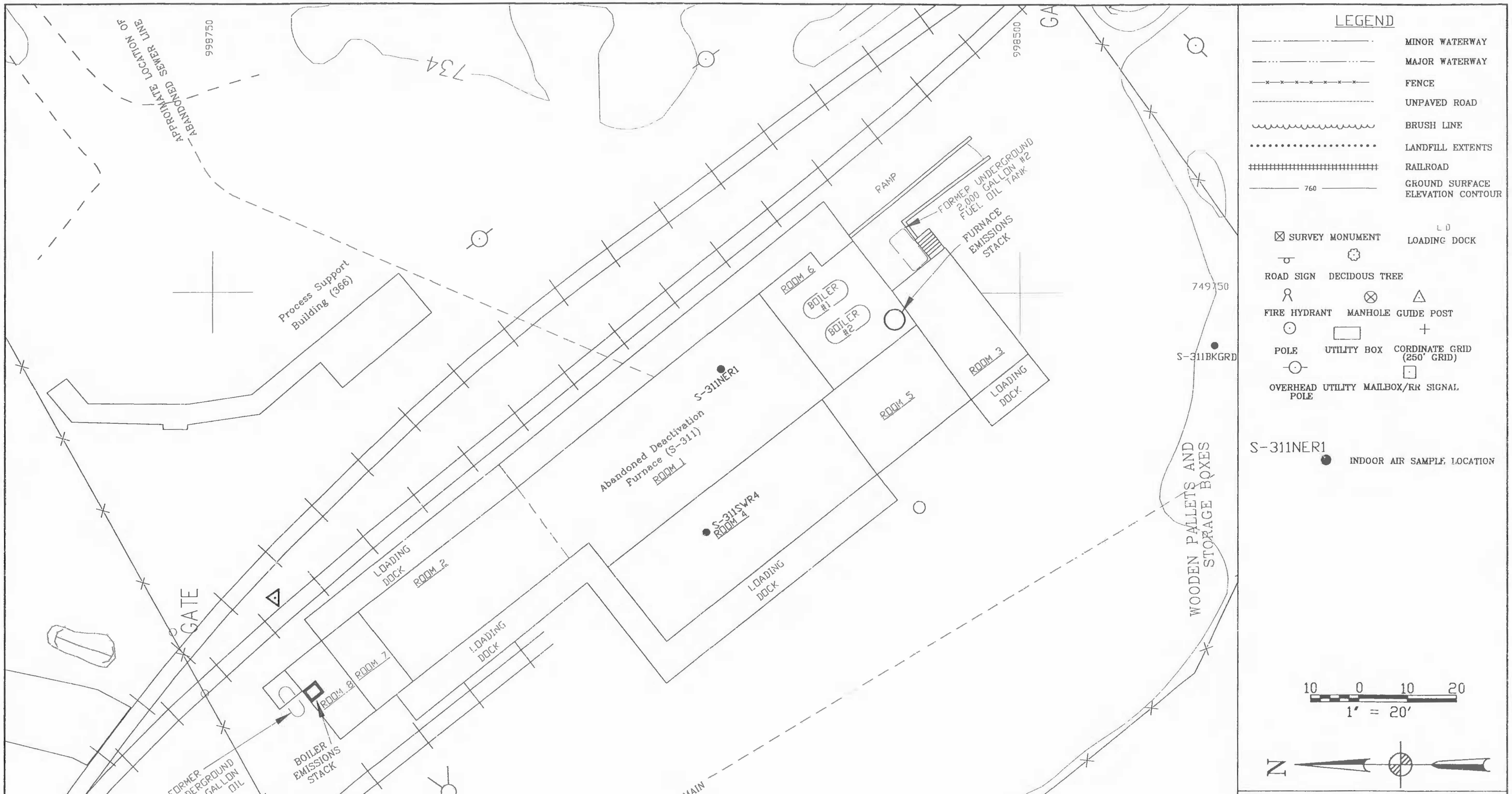
SEAD-16 ABANDONED DEACTIVATION FURNACE

DEPT	Dwg No
ENVIRONMETAL ENGINEERING	729895-01001

FIGURE 2-3
SEAD-16 LOCATION OF FLOOR AND STANDING WATER SAMPLES IN BUILDING S-311

SCALE	DATE	REV
1" = 20'	DECEMBER 1996	A



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SENECA ARMY DEPOT ACTIVITY
RI/FS
SEAD-16 ABANDONED DEACTIVATION FURNACE

DEPT	Dwg No
ENVIRONMETAL ENGINEERING	729895-01001

FIGURE 2-4
SEAD-16 BUILDING S-311
INDOOR AIR SAMPLE LOCATIONS

SCALE	DATE	REV
1" = 20'	DECEMBER 1996	A

by the CLP/TAL list. The SVOC samples were analyzed for 66 individual SVOCs as specified by the sampling method (USEPA Compendium Method TO-13).

2.3.4.2 Investigation of the Process Support Building (Building 366)

The Process Support Building (366) located to the northeast of Building S-311 was used as a storage and processing area for munitions deactivation. Elevated levels of explosives, principally 2,4-dinitrotoluene were detected in soil samples adjacent to this building during the ESI field investigation. Therefore, unexploded ordnance support was recommended during investigation of this building, which was conducted during the RI field investigation.

The Process Support Building (366) was inspected for the presence of waste debris or building materials contamination and also to evaluate the physical condition of the structure. A generalized floor plan showing the approximate location of waste debris or surface contamination was prepared on the basis of field sketches and notes (Figure 2-5). Representative samples of propellants and solid materials from the building were collected in a similar fashion to the approach used at Building S-311. Propellant residues (BS-10 and BS-11) were collected from a Hoffman vacuum sweeping system (secondary separator) in the room at the southern end of the building and from a receiving vat in the adjacent room. A sample of dirt from one location on the building floor (FS-50) was also collected in the room at the southern end of the building. Additionally, 8 building material samples were also collected for determination of asbestos content only. The exterior of the overhead piping connecting the two buildings was inspected for signs of deterioration and the presence of any residual materials.

The building material/dirt samples were submitted for chemical testing for the parameters listed in Table 2-2.

2.3.5 <u>Soils Investigation</u>

2.3.5.1 Introduction

In accordance with the workplans, a soils investigation program consisting of surface soil sampling and subsurface soil sampling using soil borings was completed at SEAD-16. During the ESI phase, no soil borings were completed while during the RI phase a total of 5 soil borings were completed at SEAD-16. The location of the various soil borings are shown in Figure 2-6. The individual soil boring logs are included in Appendix A. The objectives of the soil investigation program were to determine the nature and extent of chemical impacts in the SEAD-16 area,

Table 2-2

SEAD-16 - Solid Materials Sampling Summary
Samples from the Process Support Building (Building 366)

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

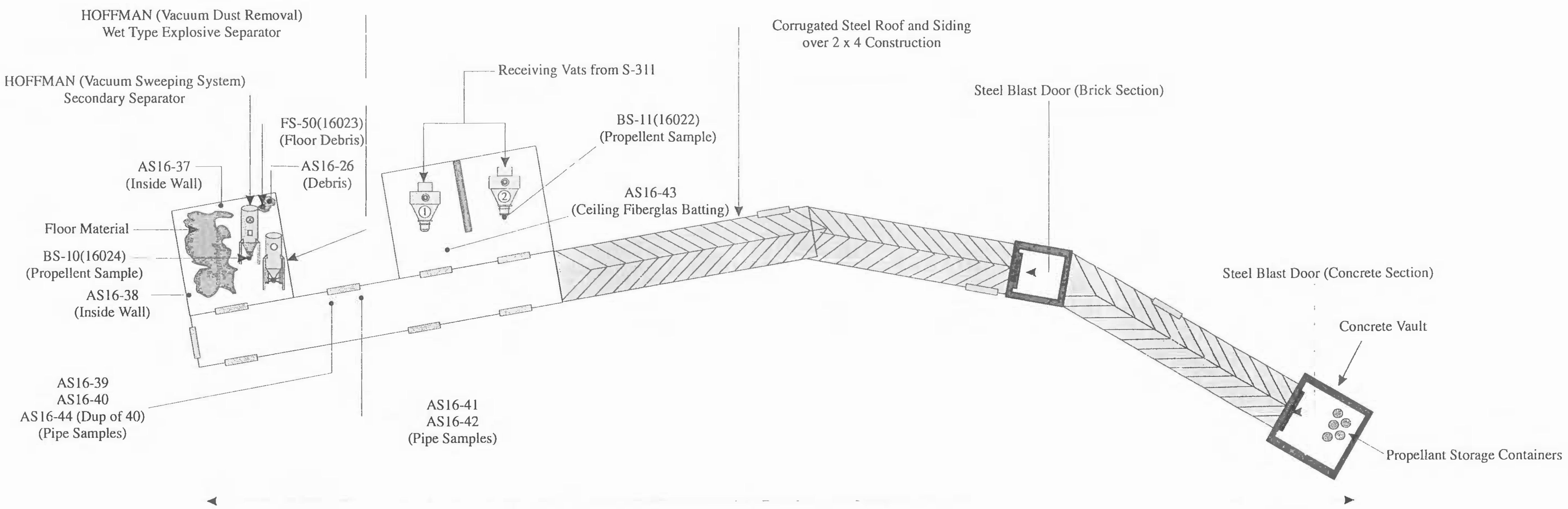
Building Sample Number	Sample ID Number	Date Sampled	Room Location	Material Description
AS-16-26	AS-16-26	08/08/96	Separator Room	Floor Debris
AS-16-37	AS-16-37	08/08/96	Separator Room	Material from the Inside Wall
AS-16-38	AS-16-38	08/08/96	Separator Room	Material from the Inside Wall
AS-16-39	AS-16-39	08/08/96	Walkway	Pipe Sample
AS-16-40	AS-16-40	08/08/96	Walkway	Pipe Sample
AS-16-41	AS-16-41	08/08/96	Walkway	Pipe Sample
AS-16-42	AS-16-42	08/08/96	Walkway	Pipe Sample
AS-16-43	AS-16-43	08/08/96	Receiving Vat Room	Ceiling Fiberglas Batting
FS-50	16023	08/08/96	Separator Room	Floor Debris
BS-10	16024	08/08/96	Separator Room	Propellant Sample
BS-11	16022	08/08/96	Receiving Vat Room	Propellant Sample

Notes:

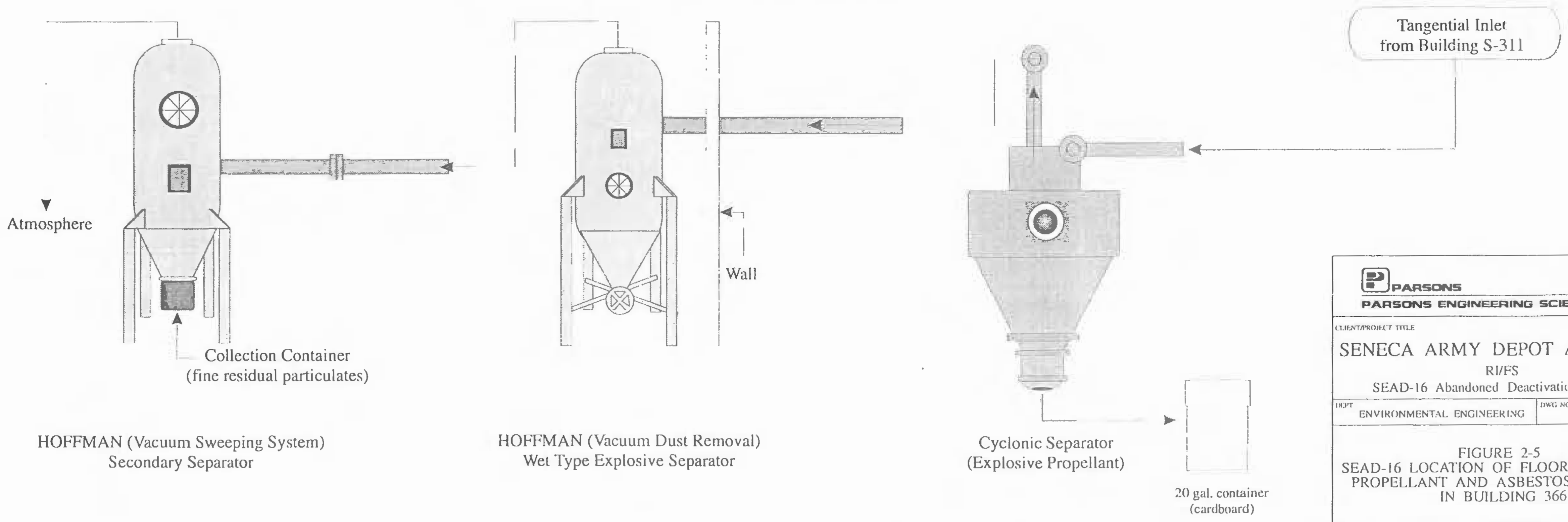
(1) AS-16-44 is a duplicate sample of AS-16-40.

(2) AS samples were analyzed for asbestos only.
FS samples were analyzed for the following parameters: volatile organics, semivolatile organics, pesticides/PCBs, metals, cyanide, explosives, and nitrate-nitrogen.

Building 366 Layout - (Plan View)



Approximate Process Flow Diagram



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SENECA ARMY DEPOT ACTIVITY
RI/FS
SEAD-16 Abandoned Deactivation Furnace

DEPT ENVIRONMENTAL ENGINEERING
DWG NO. 729895-01000

FIGURE 2-5
SEAD-16 LOCATION OF FLOOR MATERIAL, PROPELLANT AND ASBESTOS SAMPLES IN BUILDING 366

SCALE 1" = 10' (Plan View)
DATE NOVEMBER 1996

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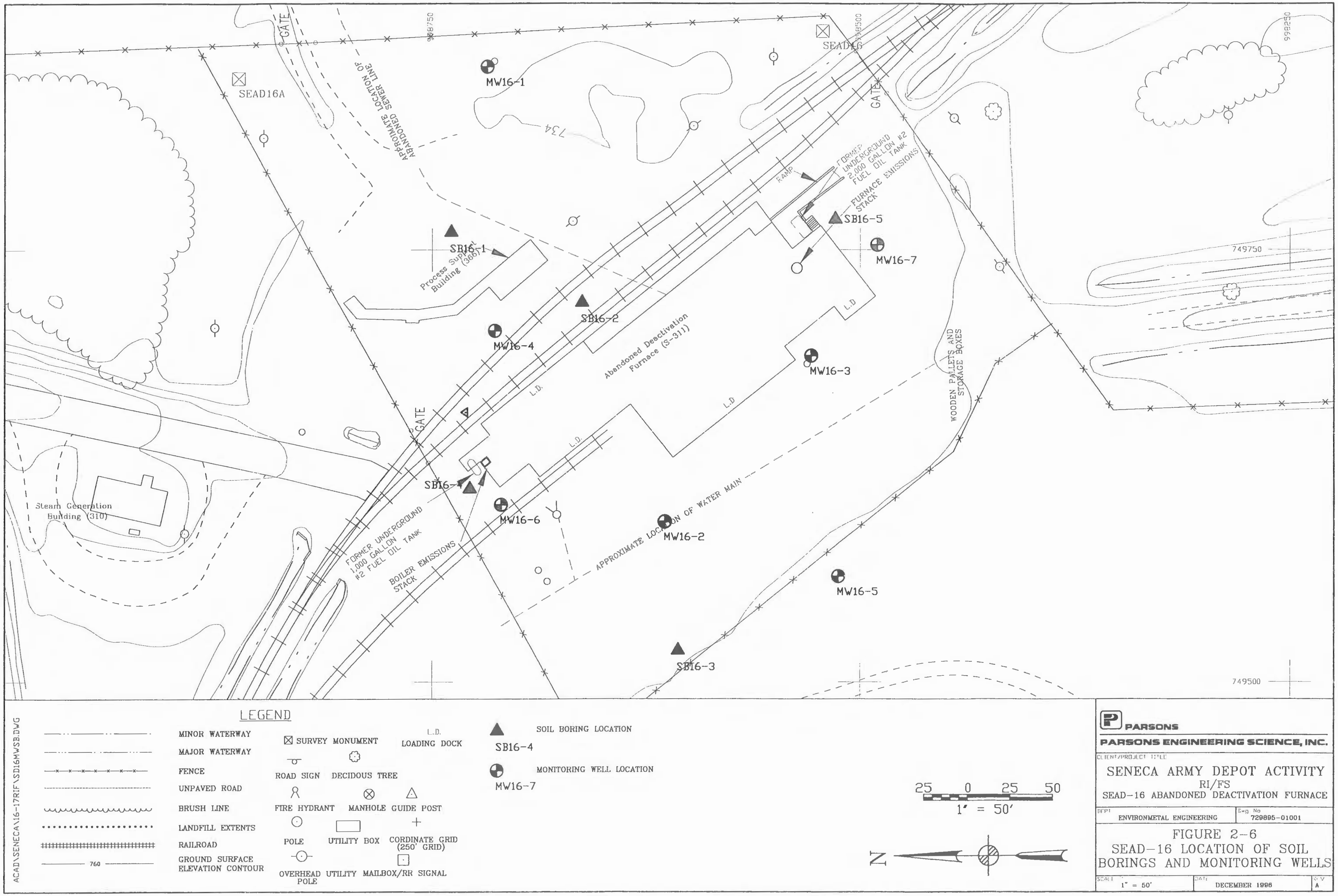

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RI/FS
SEAD-16 ABANDONED DEACTIVATION FURNACE

DEPT
ENVIRONMETAL ENGINEERING

Dwg No
729895-01001

FIGURE 2-6
SEAD-16 LOCATION OF SOIL BORINGS AND MONITORING WELLS

SCALE
1" = 50'

DATE
DECEMBER 1996

REV
A

establish the extent of impacts to surface soils at the site, locate areas for potential removal actions, and to collect soil samples for use in the risk assessment. In addition, soil samples were collected for analysis of grain size, moisture content, and Total Organic Carbon (TOC) to provide data to be used in determining remedial alternatives for the site.

2.3.5.2 Soil Borings

During the RI phase, a total of 5 soil borings were advanced at SEAD-16. The soil borings were performed at specific locations described in the SEAD-16 and SEAD-17 Project Scoping Plan. The specific locations for the five soil borings are as follows. Two of the soil borings SB16-4 and SB16-5 were drilled near the former # 2 fuel oil UST locations. The confirmatory sampling conducted after the tanks were removed showed that the subsurface soil was impacted with PAHs. One soil boring was performed at each former UST location to delineate the vertical extent of impacts. The three soil borings, SB16-1, SB16-2, and SB16-3, were drilled at locations northeast, east, and west of the building, respectively. These locations of the borings are shown on Figure 2-6.

Each soil boring was continuously sampled to the top of the water table. A maximum of three samples from each boring were collected for chemical analysis. At three locations (SB16-1, SB16-3, and SB16-4), one surface soil sample was collected from 0 to 2 inches below the organic matter. Subsurface soil samples were collected from the borings according to the procedures outlined in Section 2.2.4.1. In total, four surface soil samples and six subsurface soil samples were collected for chemical analysis in (Table 2-3).

In addition, a total of three subsurface soil samples were collected from two of the soil borings and submitted for analysis of TOC and grain size distribution. The samples obtained below the water table were analyzed to characterize the soil in the aquifer. At soil borings SB16-2 and SB16-5, near surface soil samples were collected; at soil boring SB16-5, one subsurface sample was collected.

2.3.5.3 Surface Soils

During the ESI field program, 16 surface soil samples were collected (0 to 20 inches in depth) in the vicinity of Building S-311. The locations of the surface soil samples are shown in Figure 2-7. Although at the time the ESI was performed, the samples collected from 0 to 20 inches in depth were considered surface samples, the analytical data in this RI reported for surface samples

Table 2-3

SEAD-16 - Soil Boring Sampling Summary

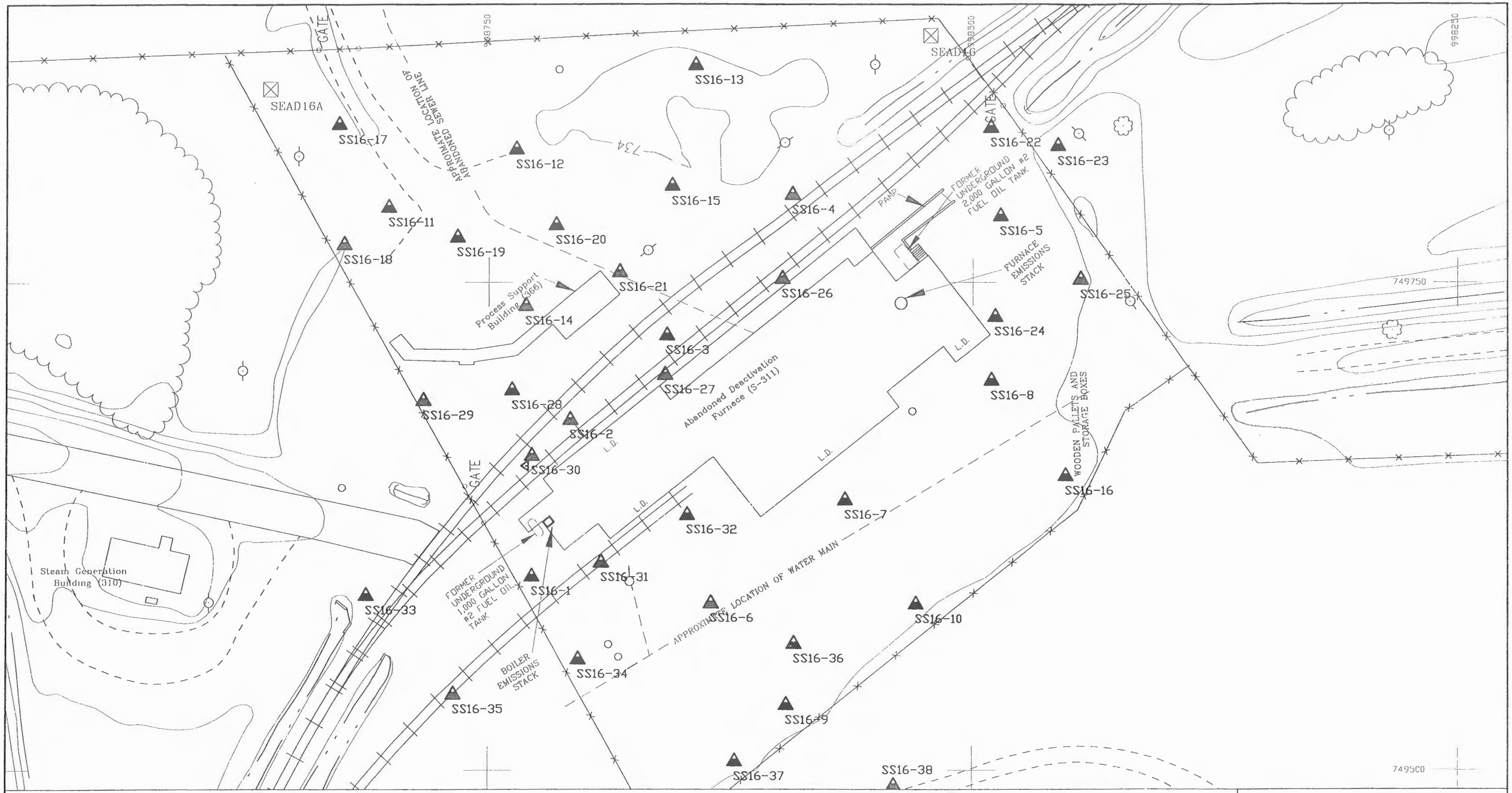
SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Soil Boring Location	Soil Boring Sample ID	Date Sampled	Sample Depth (ft)	
			Top	Bottom
SB16-1	16037	08/14/96	0.00	0.16
SB16-1	16093	08/22/96	0.50	1.00
SB16-1	16038	08/14/96	2.00	3.00
SB16-2	16036	08/14/96	1.00	2.00
SB16-3	16032	08/14/96	0.00	0.16
SB16-3 (1)	16033	08/14/96	0.00	0.16
SB16-4	16030	08/14/96	0.00	0.16
SB16-4	16031	08/14/96	2.00	4.00
SB16-5 (2)	16034	08/14/96	1.00	2.00
SB16-5 (2)	16035	08/14/96	2.00	4.00

Notes:

(1) Soil boring sample 16033 was a duplicate sample of 16032.

(2) These samples were submitted to the laboratory for Grain Size and Total Organic Carbon analyses and other chemical analyses.



LEGEND

MINOR WATERWAY
MAJOR WATERWAY
FENCE
UNPAVED ROAD
BRUSH LINE
LANDFILL EXTENTS
RAILROAD
GROUND SURFACE ELEVATION CONTOUR (760)

⊠ SURVEY MONUMENT
ROAD SIGN
DECIDOUS TREE
FIRE HYDRANT
⊗ MANHOLE
△ GUIDE POST
POLE
UTILITY BOX
\+ CORDINATE GRID (250' GRID)
OVERHEAD UTILITY POLE
MAILBOX/RR SIGNAL
L.D. LOADING DOCK
▲ SS16-23 SURFACE SOIL SAMPLE

25 0 25 50
1" = 50'

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DEPT	Dwg No.
ENVIRONMETAL ENGINEERING	729895-01001

FIGURE 2-7
SEAD-16 LOCATION OF SURFACE SOIL SAMPLES

SCALE	DATE	
1" = 50'	DECEMBER 1996	A

only include sample results for 0-2 inches below ground surface from the ESI. The remainder of the samples collected from the ESI are discussed and considered as subsurface samples.

During the RI field program, a total of 23 additional soil samples were collected. Figure 2-7 shows the surface soil sample locations (0-2 inches below the surface organic material). The objective for collecting these samples was to delineate the extent of metals and SVOCs in the surface soil. These data provided the information necessary for completion of a baseline risk assessment and development of remedial action alternatives. The locations of additional surface soil samples are centered around sampling points which exhibited the higher concentrations of metals and SVOCs from the ESI. They also served to establish the outer boundaries of surface contamination at SEAD-16 and assess the surface run-off potential at the western boundary of the site. Two of the 23 surface soil samples collected during the RI were tested for grain size distribution. The grain size distribution will be used for modeling fugitive dusts releases from surface soil to assess potential risks for this exposure pathway. In total, 39 surface soil samples were collected for chemical analysis (Table 2-4). The samples were tested according to the analyses specified in Section 2.2.4.1.

2.3.5.4 Downwind Surface Soil Samples

Fugitive dust emissions and stack emissions from SEAD-16 may have resulted in deposition of metals and SVOCs to surface soil downwind of the site. This includes the period during which the deactivation furnace was in operation (1945-1960) and the period following to the present. In order to access this transport and exposure pathway, downwind surface soil sampling was conducted during the RI field program. Surface soil samples were collected at 500 feet from Building S-311 in the two primary wind directions. Samples were also collected 1,000 feet, 2,000 feet, 3,000 feet, and 3,500 feet away from a point between SEAD-16 and SEAD-17 in the two primary wind directions. In total, 11 surface soil samples were collected (Table 2-4). The primary wind directions at SEDA are to the north-northwest and the south-southeast.

The data gathered for the samples collected at 1,000 feet, 2,000 feet, 3,000 feet, and 3,500 feet along both sides of the downwind transect will be used to assess the downwind transportation of contaminants for both SEAD-16 and SEAD-17. All of the downwind sample locations along the north-northwest/south-southeast azimuth and the wind rose used to determine the primary wind direction are shown in Figure 2-8. The wind rose data, was gathered at SEDA and the airport in Ithaca, New York.

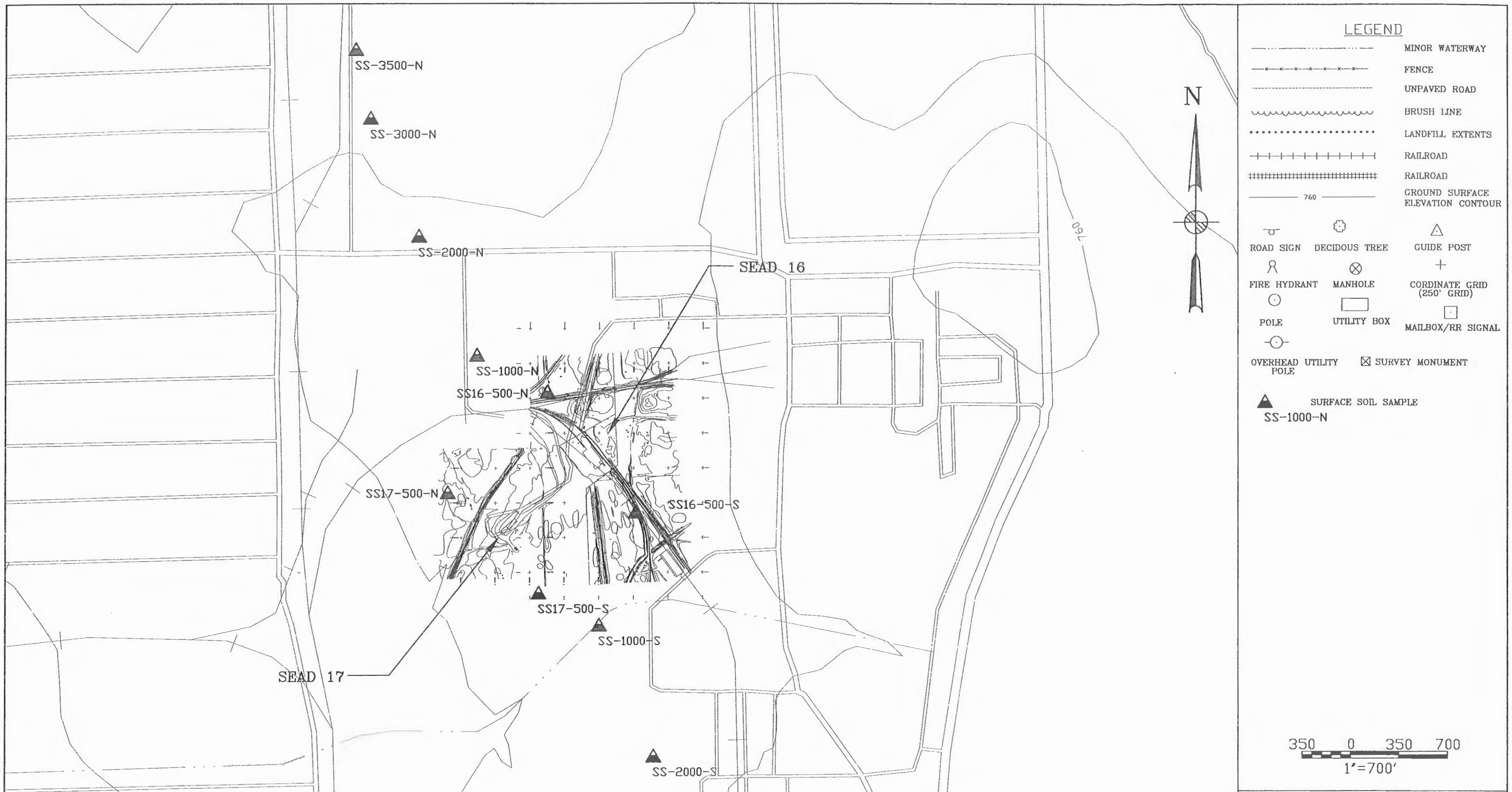
Table 2-4

SEAD-16 - Surface Soil Sampling Summary

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Surface Soil Location	Surface Soil Sample ID	Date Sampled	Sample Depth (ft)	
			Top	Bottom
SS16-1	SS16-1-1	10/20/93	0	0.17
SS16-2	SS16-2-1	10/20/93	0	0.17
SS16-3	SS16-3-1	10/22/93	0	0.17
SS16-4	SS16-4-1	10/20/93	0	0.17
SS16-5	SS16-5-1	10/20/93	0	0.17
SS16-6	SS16-6-1	10/20/93	0	0.17
SS16-7	SS16-7-1	10/20/93	0	0.17
SS16-8	SS16-8-1	10/20/93	0	0.17
SS16-9	SS16-9-1	11/09/93	0	0.17
SS16-10	SS16-10-1	11/09/93	0	0.17
SS16-11	SS16-11-1	10/20/93	0	0.17
SS16-12	SS16-12-1	10/20/93	0	0.17
SS16-13	SS16-13-1	10/20/93	0	0.17
SS16-14	SS16-14-1	10/20/93	0	0.17
SS16-15	SS16-15-1	10/20/93	0	0.17
SS16-16	SS16-16-1	10/20/93	0	0.17
SS16-17	16040	08/19/96	0	0.17
SS16-18	16041	08/19/96	0	0.17
SS16-19	16042	08/19/96	0	0.17
SS16-20	16043	08/19/96	0	0.17
SS16-21	16058	08/21/96	0	0.17
SS16-22	16049	08/20/96	0	0.17
SS16-22 (1)	16059	08/20/96	0	0.17
SS16-23	16051	08/20/96	0	0.17
SS16-24	16060	08/21/96	0	0.17
SS16-25	16050	08/20/96	0	0.17
SS16-26	16046	08/20/96	0	0.17
SS16-27 (2)	16047	08/20/96	0	0.17
SS16-28	16044	08/19/96	0	0.17
SS16-29	16045	08/19/96	0	0.17
SS16-30	16048	08/20/96	0	0.17
SS16-31	16062	08/21/96	0	0.17
SS16-32	16052	08/20/96	0	0.17
SS16-33	16067	08/22/96	0	0.17
SS16-34	16053	08/20/96	0	0.17
SS16-35	16066	08/22/96	0	0.17
SS16-36	16061	08/21/96	0	0.17
SS16-37	16054	08/20/96	0	0.17
SS16-38 (2)	16068	08/22/96	0	0.17
500S	16086	08/22/96	0	0.17
1000S	16087	08/22/96	0	0.17
2000S	16085	08/22/96	0	0.17
3000S	16056	08/20/96	0	0.17
3500S	16055	08/20/96	0	0.17
500N	16074	08/22/96	0	0.17
1000N	16083	08/22/96	0	0.17
2000N	16089	08/22/96	0	0.17
2000N (3)	16090	08/22/96	0	0.17
3000N	16088	08/22/96	0	0.17
3500N	16084	08/22/96	0	0.17

Notes:
(1) Sample 16059 is a duplicate sample of 16049 at location SS16-22.
(2) Samples for TOC and grain size collected at this location.
(3) Sample 16090 is a duplicate sample of 16089 at location 2000N.



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RI/FS
SEAD-16 AND SEAD-17

DEPT. ENVIRONMENTAL ENGINEERING

Dwg. No 729895-01001

FIGURE 2-8
SEAD-16 & SEAD-17 LOCATION
OF DOWNWIND SURFACE SOIL SAMPLES

SCALE NA

DATE DECEMBER 1996

REV A

ACAD\SENECA\16-17RIF\SD1617SW.DWG

For SEAD-16, six samples were collected to the north-northwest of the area and five samples were collected to the south-southeast. These samples include two samples collected at 500 feet from SEAD-16 and eight samples collected along the north-northwest/south-southeast transect. The two additional samples shown in Figure 2-8 were collected and analyzed to assess the downwind transportation of contaminants from SEAD-17. All samples were collected from 0-2 inches below the surface organic material. The downwind surface soil samples were tested according to the analyses specified in Section 2.2.4.1.

2.3.6 Groundwater Investigation

2.3.6.1 Introduction

The purpose of the groundwater monitoring program at SEAD-16 was to define the horizontal and vertical extent of impacted groundwater, determine the directions of groundwater flow on the site, determine the hydrogeologic properties of the aquifer to assess contaminant migration and potential remedial actions, and determine the background groundwater quality.

During the ESI, three monitoring wells were installed and the direction of groundwater flow was determined to be to the southwest. During the RI, a total of four monitoring wells were installed. All of the monitoring wells were screened in the till/weathered shale aquifer. In addition, physical characteristics of the till/weathered shale aquifer and the general groundwater flow conditions were investigated through measurements of depth to water and slug tests. The locations of all seven monitoring wells are shown in Figure 2-6. Monitoring well construction details for all wells at SEAD-16 are presented in Table 2-5, and monitoring well completion diagrams are included in Appendix C.

2.3.6.2 Monitoring Well Installation

ESI Program

During the ESI, a total of three monitoring wells were installed at this site. One monitoring well, MW16-1, was installed upgradient and northeast of the site to obtain background water quality data. The remaining two wells, MW16-2 and MW16-3, were installed adjacent to and downgradient of Building S-311 to determine if hazardous constituents have migrated from the site and to determine the direction of groundwater flow. At the time of the ESI program, the presumed direction of groundwater flow at this site was to the southwest, which the geophysical survey later

Table 2-5

SEAD-16 - Monitoring Well Construction Details

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Well ID	Well Type (1)	Depth of Well Relative to Ground Surface (ft)	Depth of Well Relative to Top of PVC (ft)	Diameter of Boring/Core (in)	Diameter of Well (in)	Well Screen Length (ft)	Screened Interval Relative to Ground Surface (ft)	Well Screen Slot Size (in)	Thickness of Bentonite Seal (ft)	Height of PVC Well Stickup (ft)	Elevation of Top of PVC Well (MSL)	Well Casing Material	Well Screen Material
MW16-1	T/WS	6.0	7.8	8.0	2.0	2.0	3.3 to 5.3	0.01	2.2	1.8	735.5	PVC	PVC
MW16-2	T/WS	4.1	5.8	8.0	2.0	2.0	1.4 to 3.4	0.01	1.1	1.7	734.6	PVC	PVC
MW16-3	T/WS	5.0	7.4	8.0	2.0	2.0	2.3 to 4.3	0.01	1.8	2.4	735.5	PVC	PVC
MW16-4	T/WS	5.2	6.8	8.0	2.0	2.0	2.5 to 4.5	0.01	1.0	1.6	733.9	PVC	Wire wrapped PVC
MW16-5	T/WS	4.0	5.3	8.0	2.0	2.0	1.3 to 3.3	0.01	0.4	1.3	733.4	PVC	Wire wrapped PVC
MW16-6	T/WS	5.1	6.6	8.0	2.0	2.3	2.6 to 4.9	0.01	0.7	1.5	733.6	PVC	Wire wrapped PVC
MW16-7	T/WS	5.3	6.9	8.0	2.0	2.0	2.6 to 4.6	0.01	0.7	1.6	734.4	PVC	Wire wrapped PVC

confirmed. One monitoring well was constructed at each designated location and was screened over the entire thickness of the aquifer above the competent bedrock (Table 2-5).

RI Program

During the RI, a total of four monitoring wells were installed at SEAD-16 and were screened in the saturated overburden aquifer overlying the competent shale bedrock. The four monitoring wells were located to obtain geographic coverage of the site. MW16-4 was located between Building S-311 and the explosives/munitions storage and processing building in order to determine the groundwater quality adjacent to the storage building. MW16-5 was located southwest of Building S-311 in order to collect groundwater quality data downgradient of the site. MW16-6 was located at the northwest side of Building S-311 near the former UST to determine whether a release of petroleum hydrocarbons from the 1,000-gallon UST (Tank 311-A) has impacted the groundwater. MW16-7 was located at the southeastern side of Building S-311 near the other former UST to determine whether a release of petroleum hydrocarbons from the 2,000-gallon UST (Tank 311-B) has impacted groundwater.

2.3.6.3 Monitoring Well Development

Subsequent to the monitoring well installation, each monitoring well was developed to insure that a proper hydraulic connection existed between the borehole and the surrounding aquifer. One of the wells (MW16-5) was dry at the time of development. The well development parameters for the ESI and the RI are summarized in Table 2-6. Details of the procedure are presented in Section 2.2.5.2.

2.3.6.4 Groundwater Sampling

During the ESI, one groundwater sample was collected from each of the three monitoring wells, MW16-1, MW16-2, and MW16-3, following installation and development. The samples were analyzed for the parameters listed in Section 2.2.5.3. The monitoring wells were sampled using the procedure described in Section 2.2.5.3.

For the RI, groundwater samples were proposed to be collected from all seven monitoring wells at SEAD-16 over two distinct times of the year, and analyzed for the parameters listed in Section 2.2.5.3. The first round of sampling was completed in August 1996 and one well was dry during this event (MW16-5), and thus it was not sampled. The second round of groundwater sampling was conducted in early December 1996, samples were collected from all seven wells for this event. The second set of samples are being analyzed using the same methods as the first set (The December data are not yet available from the laboratory). The wells were sampled using the latest

Table 2-6

SEAD-16 - Monitoring Well Development Information

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Well ID	Installation Date	Development Method	Field-Measured Parameters (1)				Gallons of Purge Water Removed	Well Volumes Removed
			Temperature (°C)	Specific Conductivity (umhos)	pH	Turbidity (NTU)		
MW16-1	10/26/93	Teflon Bailer & Pump	12.3	600	6.78	6.9	18.00	5.00
MW16-2	10/26/93	Teflon Bailer & Pump	9.8	490	6.90	0.3	11.50	5.00
MW16-3	10/26/93	Teflon Bailer & Pump	9.4	265	6.87	7.9	13.80	4.90
MW16-4	08/14/96	Surge Block & Pump	25.6	NR	6.52	3.4	7.75	2.90
MW16-5	08/13/96	Dry well	NA	NA	NA	NA	NA	NA
MW16-6	08/14/96	Surge Block & Pump	33.6	NR	7.06	>100	4.00	1.40
MW16-7	08/13/96	Surge Block & Pump	NR	NR	NR	4.9	12.00	6.00

Note:
1) Measurements taken after well development was completed.
NA = data not collected (dry well)
NR = data is unavailable

version of the EPA groundwater sampling procedure as described in Section 2.2.5.3 The field sampling data are presented in Table 2-7.

2.3.7 Aquifer Testing

Duing the ESI, groundwater levels were measured at the three monitoring wells MW16-1, MW16-2, and MW16-3, on April 4, 1994.

During the RI, three rounds of water level measurements were performed at all seven monitoring wells. One round of measurements was taken before well development and this data was used only for well development calculations. The second round of water levels was performed before the first round of groundwater sampling in August 1996. The final round of measurements were performed before the second round of groundwater sampling, which was completed in December 1996. The second and third rounds were used to create groundwater topography maps.

Slug tests were performed during the RI field program at the six of the seven monitoring wells on site to determine hydraulic conductivities. In one of the wells, (MW16-5), there was very little water and the water level was below the bottom of the screen, therefore, a meaningful test could not be performed. Generally, the low water table conditions that characterize the late summer and early fall did not allow the use of a transducer and data logger to record the slug test data. For the reason, many of the tests were performed by hand using a slug, electronic water level meter, and stop watch. Also, the amounts of water displaced in the wells for the tests were small. The slug test parameters and related information are shown in Table 2-8. The procedures for slug testing are provided in Section 2.2.6.2.

2.3.8 Surface Water and Sediment Investigation

The objectives of the surface water and sediment investigation at SEAD-16 were to determine the nature and extent of chemical impacts in the drainage ditches in the immediate vicinity of the site, to establish the potential for impacts to off-site surface water and sediment, and to obtain a background surface water and sediment sample to allow comparison to SEAD-16 data. The results from the surface water and sediment sampling program were also used to determine the potential exposure levels for the risk assessment. The sample program for surface water and sediment is summarized in Table 2-9. Sample locations are shown in Figure 2-9. The sampling procedures are described in Section 2.2.7. Surface water and sediment samples were collected during the RI field program.

Table 2-7

SEAD-16 - Monitoring Well Field Sampling Information (1)

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Well ID	Sample ID	Date Sampled	Field-Measured Parameters						Gallons of Purge Water Removed	Standing Water Volume (gal)	Well Volumes Removed
			Temperature (°C)	Specific Conductivity (umhos)	pH	Eh (millivolts)	Dissolved Oxygen (mg/L)	Turbidity (NTU)			
MW16-1	MW16-1-1	11/19/93	9.90	575	7.30	NA	NA	NA	3.00	0.75	4.00
MW16-1	16101	08/27/96	19.90	963	6.72	325	3.30	19.00	3.75	0.24	15.63
MW16-2	MW16-2-1	11/19/93	9.30	525	7.60	NA	NA	NA	1.20	0.40	3.00
MW16-2 (3)	MW16-41-1	11/19/93	9.30	525	7.60	NA	NA	NA	1.20	0.40	3.00
MW16-2	16102	08/27/96	8.86	973	6.96	62	0.14	1.90	2.50	1.10	2.27
MW16-3	MW16-3-1	11/19/93	9.70	260	7.70	NA	NA	NA	1.50	0.50	3.00
MW16-3	16110	09/10/96	8.26	712	6.81	143	0.54	4.22	1.90	1.10	1.73
MW16-3 (4)	16115	09/10/96	8.26	712	6.81	143	0.54	4.22	1.90	1.10	1.73
MW16-4	16105	08/28/96	15.06	720	7.10	1.64	0.22	5.56	5.50	3.10	1.77
MW16-5 (2)	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW16-6	16111	09/03/96	12.29	927	5.34	326	3.51	4.19	18.00	1.85	9.73
MW16-7	16104	08/28/96	15.74	920	7.19	158	1.6	6.06	6.00	4.80	1.25

Notes:
(1) Final measurements taken after well puring was completed.
(2) NS = Not sampled. There was an insufficient amount of standing water to sample.
(3) Sample MW16-41-1 is a duplicate sample of MW16-2-1 at location MW16-2.
(4) Sample 16115 is a duplicate sample of 16110 at location MW16-3.

Table 2-8

SEAD-16-Data for Slug Test Hydraulic Conductivity Determinations

SEAD-16 & SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Well I.D.	Test Name	Well Type (1)	Depth to Bottom of Aquifer Relative to Top of PVC (2) (ft)	Well Point Relative to Top of PVC (ft) (3)	Screened Interval Relative to Top of PVC (ft)	Static Water Level Relative to Top of PVC (ft)	Initial Drawdown Relative to Top of PVC (ft)	Initial Drawdown Relative to static (ft) (2)	Internal Radius of Well Casing (ft) (2)	Effective Radius of Well Boring (ft) (2)	Saturated Thickness of Aqufer Static (ft) (2)	Screen Length - saturated (ft) (2)	Height of Water Column - Static (ft) (2)	Comments
MW16-1	MW161	T/WS	8.02	8.02	5.32 7.32	6.95	7.45	0.50	0.083	0.35	1.07	0.37	1.07	Hand run test
MW16-2	MW162	T/WS	6.08	6.08	3.38 5.38	4.94	5.30	0.36	0.083	0.35	1.14	0.44	1.14	Hand run test
MW16-3	MW163A	T/WS	7.42	7.42	4.72 6.72	5.78	6.13	0.35	0.083	0.35	1.64	0.94	1.64	Hand run test
MW16-3	MW163B	T/WS	7.42	7.42	4.72 6.72	5.46	6.24	0.78	0.083	0.35	1.96	1.26	1.96	Hand run test
MW16-4	MW164A	T/WS	7.13	7.13	4.43 6.43	5.15	5.68	0.53	0.083	0.33	1.98	1.28	1.98	Hand run test
MW16-4	MW164B	T/WS	7.13	7.13	4.43 6.43	5.26	5.64	0.38	0.083	0.33	1.87	1.17	1.87	Hand run test
MW16-5	no test	T/WS	5.48	5.48	2.78 4.78	4.92	NA	NA	0.083	0.33	0.56	-0.14	0.56	Water below bottom of screen
MW16-6	MW166	T/WS	6.92	6.92	4.42 6.72	5.10	5.30	0.20	0.083	0.33	1.82	1.62	1.82	Hand run test
MW16-7	MW167	T/WS	6.90	6.90	4.20 6.20	5.44	5.84	0.40	0.083	0.33	1.46	0.76	1.46	Hand run test

Notes:
(1) T/WS = Till Weathered Shale Aqufier
(2) Input data to determine hydraulic conductivity with the AQTESOLV program.
(3) Well point depths may vary from those measured during well construction because sediments in the bottom of the well are removed during well development.
NA = Not Available

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FIGURE 2-10

STUDY AREA FOR SIGNIFICANT NATURAL RESOURCES WITHIN 2.0 MILES OF SEAD-16

1" = 2000'

JANUARY 1997

A

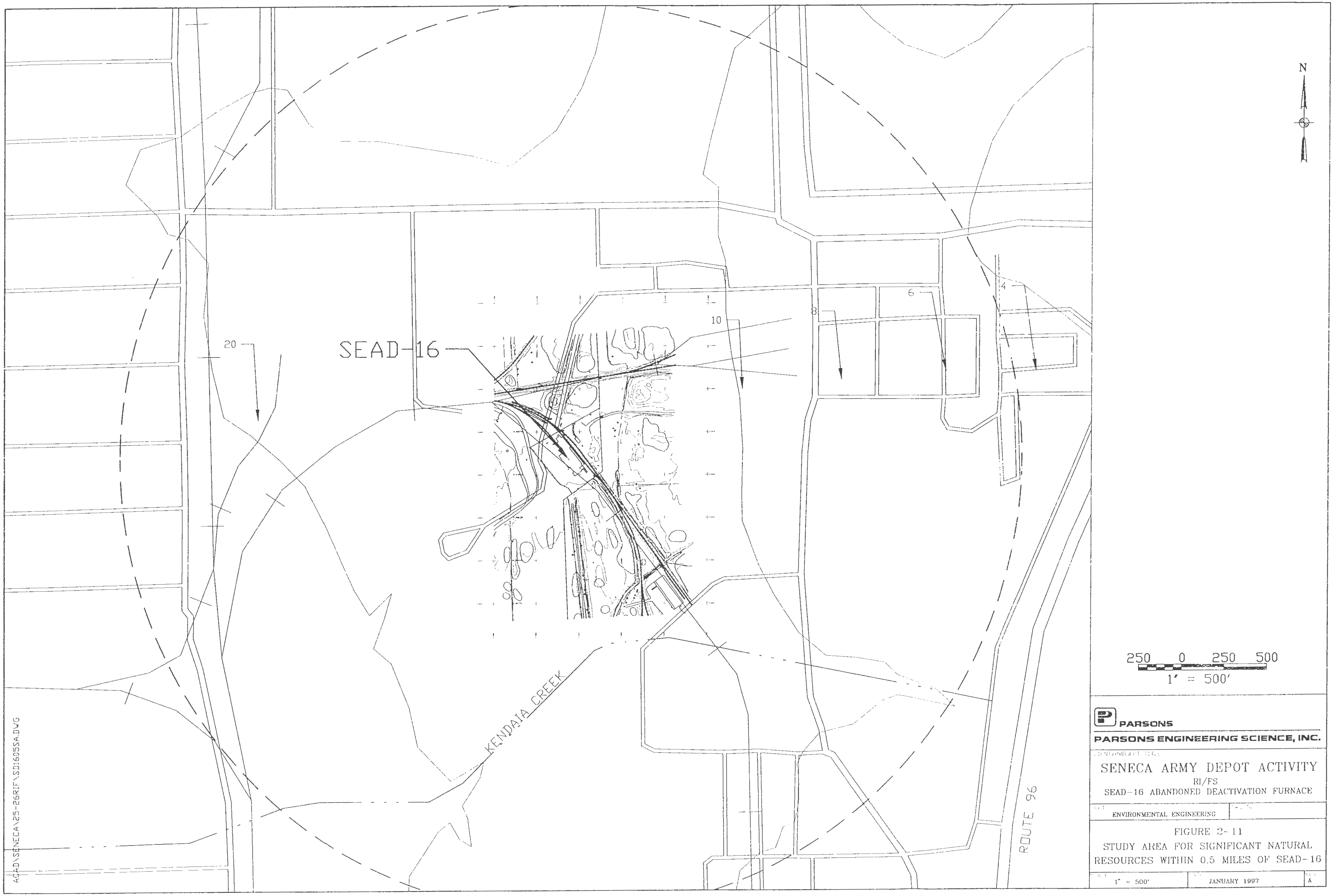

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FIGURE 2-11
STUDY AREA FOR SIGNIFICANT NATURAL RESOURCES WITHIN 0.5 MILES OF SEAD-16

1" = 500'
JANUARY 1997
A

2.4 SEAD-17: EXISTING DEACTIVATION FURNACE (Building 367)

2.4.1 Introduction

The following field investigations were performed to complete the ESI and RI characterization of SEAD-17:

- Site Surveying Program
- Geophysical Investigation
- Soil Investigation,
- Groundwater Investigation,
- Surface Water and Sediment Investigation, and
- Ecological Investigation

2.4.2 Site Survey Program

Two site survey programs were conducted at SEAD-17; one during the ESI phase of the work and one during the RI phase.

The site survey program, which was conducted as part of the ESI, consisted of field reconnaissance, ground control, aerial photogrammetry, and a field survey of the location, identification, and elevation of monitoring wells, soil borings and all other sampling points involved in the ESI field program. A reconnaissance of the site was performed to locate general site features and confirm the presence of significant features (i.e., monitoring wells, access roads) identified in the Ten SWMU ESI Workplan. Also, sampling locations were identified and marked during this initial survey.

The site and surrounding area was photographed from the air on December 14, 1993 for the purpose of constructing a photogrammetric site plan with 2-foot contour intervals. This photogrammetric map was used as the basis for the site base map. Ground control was performed during the months of November 1993 through February 1994. During the field survey, all sampling locations and monitoring wells were located and surveyed. Each location was referenced to the New York State Plane Coordinate System.

The site survey program conducted during the RI field program involved a field survey. The location, identification, coordinates and elevations of all the soil borings, monitoring wells (new and existing), and all surface water/sediment sampling points were surveyed and plotted on the site base map to show their location with respect to surface features within the project area. Figure 1-4 presents the SEAD-17 Site Plan.

2.4.3 Geophysical Investigation

Four seismic refraction profiles (P1, P2, P3 and P4) each 115-feet long, were surveyed during the ESI (Figure 2-12). Data from the surveys were used to estimate the direction of groundwater flow, then, when necessary, the location of the monitoring wells were adjusted to locate wells up and downgradient of the site.

2.4.4 Soil Investigation

2.4.4.1 Introduction

In accordance with the workplans, a comprehensive soils investigation program was completed at SEAD-17. During the ESI phase of the work, four soil borings were completed for sampling purposes while during the RI phase no soil borings were completed for sampling purposes. The location of the various soil borings are shown in Figure 2-13. The individual boring logs are included in Appendix A. The objectives of the soil investigation program were to determine the nature and extent of chemical impacts to the soils at SEAD-17, locate areas for potential removal actions, collect samples for the risk assessment, and collect surface soil samples to evaluate the extent of chemicals. In addition, soil samples were collected for analysis of grain size, moisture content, and TOC to provide data to be used in determining remedial alternatives for the site.

2.4.4.2 Soil Borings

During the ESI phase, a total of four soil borings were drilled at SEAD-17 where monitoring wells would be installed (Figure 2-13). One boring ,SB17-1, was drilled upgradient of the site and three soil borings were drilled downgradient of Building 367. Soil boring SB17-2 was located at the northwest side of the building. SB17-3 was located directly downgradient of the building and SB17-4 was located downgradient of the above-ground storage tank. Monitoring wells were installed in each of these completed borings. Two to three soil samples from each boring were submitted for chemical analyses as identified in Section 2.2.4.1. At each location, one soil sample was collected from the top 2 feet of soil. One to two additional subsurface soil samples were collected from the borings according to the procedures outlined in Section 2.2.4.1. In total, ten soil samples were collected for chemical testing (Table 2-10).

Eleven surface water and 11 sediment samples (including one duplicate of each) were collected in the drainage ditches on the east, south, and west sides of the site (Table 2-9). The sampling was completed during September 1996.

Three surface water/sediment samples, SW/SD16-2, SW/SD16-3, and SW/SD16-4, were collected in the drainage ditches southwest of Building S-311 and adjacent to the railroad tracks. Four samples, SW/SD16-5, SW/SD16-6, SW/SD16-7, and SW/SD16-8, were collected in the drainage ditches south of Building S- 311. One sample, SW/SD16-1was collected in the northern corner of Building S-311. Two samples, SW/SD16-9 and SW/SD16-10, were collected along the railroad tracks leading from the northwestern corner of Building S- 311.

These locations were chosen to determine the surface water and sediment quality at background locations and at locations adjacent to and downstream of the site. Surface water and sediment sampling occurred on September 18, 1996 during and immediately after a rainstorm event when there was water in the drainage channels and streams. This information was used to delineate the extent of chemical impacts on-site and identify areas where chemicals have migrated off-site.

2.3.9 Ecological Investigation

An important component in establishing the environmental risk associated with a hazardous waste site is to identify the potential impacts to the on-site and off-site aquatic and terrestrial communities. The overall objectives of this ecological investigation were to characterize the existing aquatic and terrestrial biotic environment on and near SEAD-16, to delineate any wetlands in and around SEAD-17, and to perform an ecological assessment to systematically document visual observations discriminating between obviously and potentially impacted and non-impacted areas. This final objective will determine if there is a need for further ecological investigations.

The ecological assessment included the development of a site description that addressed existing environmental conditions, and the characterization of local ecological resources. The ecological assessment followed the requirements outlined as Step I and Step IIA of the NYSDEC Division of Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites. The requirements are discussed in more detail in Section 2.2.8. No biological sample collection or inventory was conducted for the investigation, with the exception of minnow trapping. Multiple site visits were conducted during the fall of 1996 to evaluate the habitat conditions within the radius of concern around SEAD-16. A general vegetative covertype map was prepared within a 2-mile radius of the site as shown in Figure 2-10. A more detailed vegetative covertype map of the one-half mile radius was also prepared and is shown in Figure 2-11.

Table 2-9

SEAD-16 - Surface Water and Sediment Sampling Summary

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Surface Water and Sediment Sampling Location	Surface Water Sample ID	Sediment Sample ID	Date Sampled	Sediment Sample Depth (in)	Surface Water Field-Measured Parameters				
					Temperature (°C)	pH	Specific Conductivity (umhos)	Dissolved Oxygen (mg/L)	Turbidity (NTU)
SW/SD16-1	16143	16143A	09/18/96	0 to 6	19.5	5.61	403	5.4	NA
SW/SD16-2	16135	16135A	09/18/96	0 to 6	19.9	5.25	440	NA	1.46
SW/SD16-3	16133	16133A	09/18/96	0 to 6	19.0	5.5	395	NA	1.05
SW/SD16-4	16119	16119A	09/18/96	0 to 6	19.0	6.27	420	NA	NA
SW/SD16-4 (1)	16125	16125A	09/18/96	0 to 6	19.0	6.27	420	NA	NA
SW/SD16-5	16142	16142A	09/18/96	0 to 6	19.0	5.4	415	NA	0.95
SW/SD16-6	16126	16126A	09/18/96	0 to 6	17.0	5.8	245	NA	13.70
SW/SD16-7	16127	16127A	09/18/96	0 to 6	20.5	5.3	450	NA	1.51
SW/SD16-8	16134	16134A	09/18/96	0 to 6	17.0	5.8	245	NA	0.79
SW/SD16-9	16128	16128A	09/18/96	0 to 6	20.5	5.9	255	8.9	8.41
SW/SD16-10	16129	16129A	09/18/96	0 to 6	19.0	6.3	249	8.5	2.27

Notes:
(1) Surface water sample 16125 is a duplicate of surface water sample 16119. Sediment sample 16125A is a duplicate of sediment sample 16119A.

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729895-01001

FIGURE 2-12
SEAD-17 LOCATION OF GEOPHYSICAL SURVEYS

SCALE
1" = 100'

DATE
DECEMBER 1996

REV
A

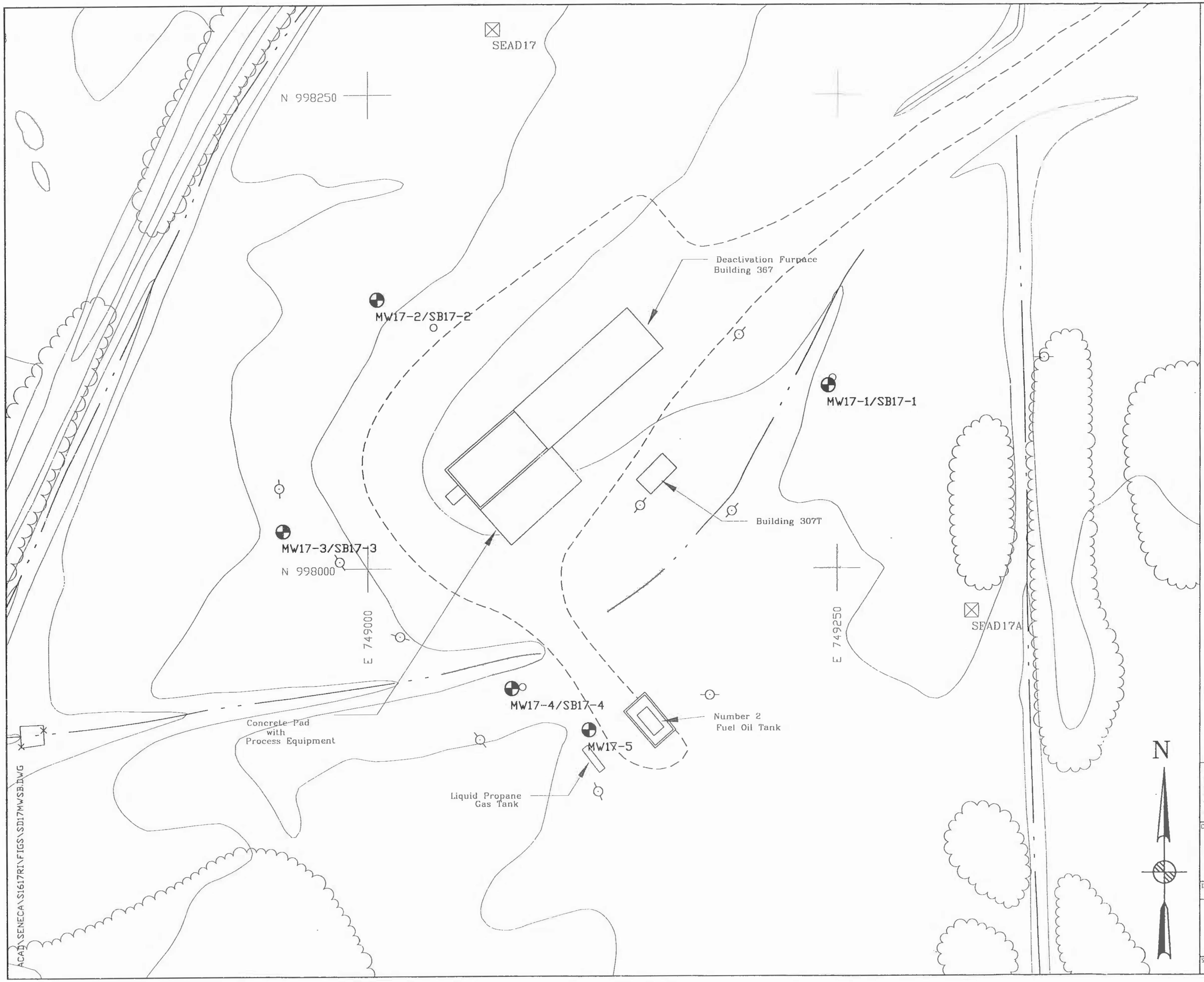

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FIGURE 2-13
SEAD-17 LOCATION OF SOIL BORINGS
AND MONITORING WELLS

SCALE	DATE	REV
1" = 50'	DECEMBER 1996	A

Table 2-10

SEAD-17 - Soil Boring Sampling Summary

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Location	Sample ID	Date Sampled	Sample Depth (ft)	
			Top	Bottom
SB17-1	SB17-1-1	12/01/93	0	2
SB17-1	SB17-1-2	12/01/93	2	4
SB17-1	SB17-1-3	12/01/93	4	6
SB17-2	SB17-2-1	10/27/93	0	2
SB17-2	SB17-2-2	10/27/93	2	4
SB17-2 (1)	SB17-2-10	10/27/93	2	4
SB17-3	SB17-3-1	11/30/93	0	2
SB17-3	SB17-3-2	11/30/93	2	4
SB17-4	SB17-4-1	11/30/93	0	2
SB17-4	SB17-4-2	11/30/93	2	4

Note:
(1) Soil boring sample SB17-2-10 is a duplicate sample of SB17-2-2.

RI Program

No soil borings for sampling purposes were drilled during the RI phase.

2.4.4.3 Surface Soils

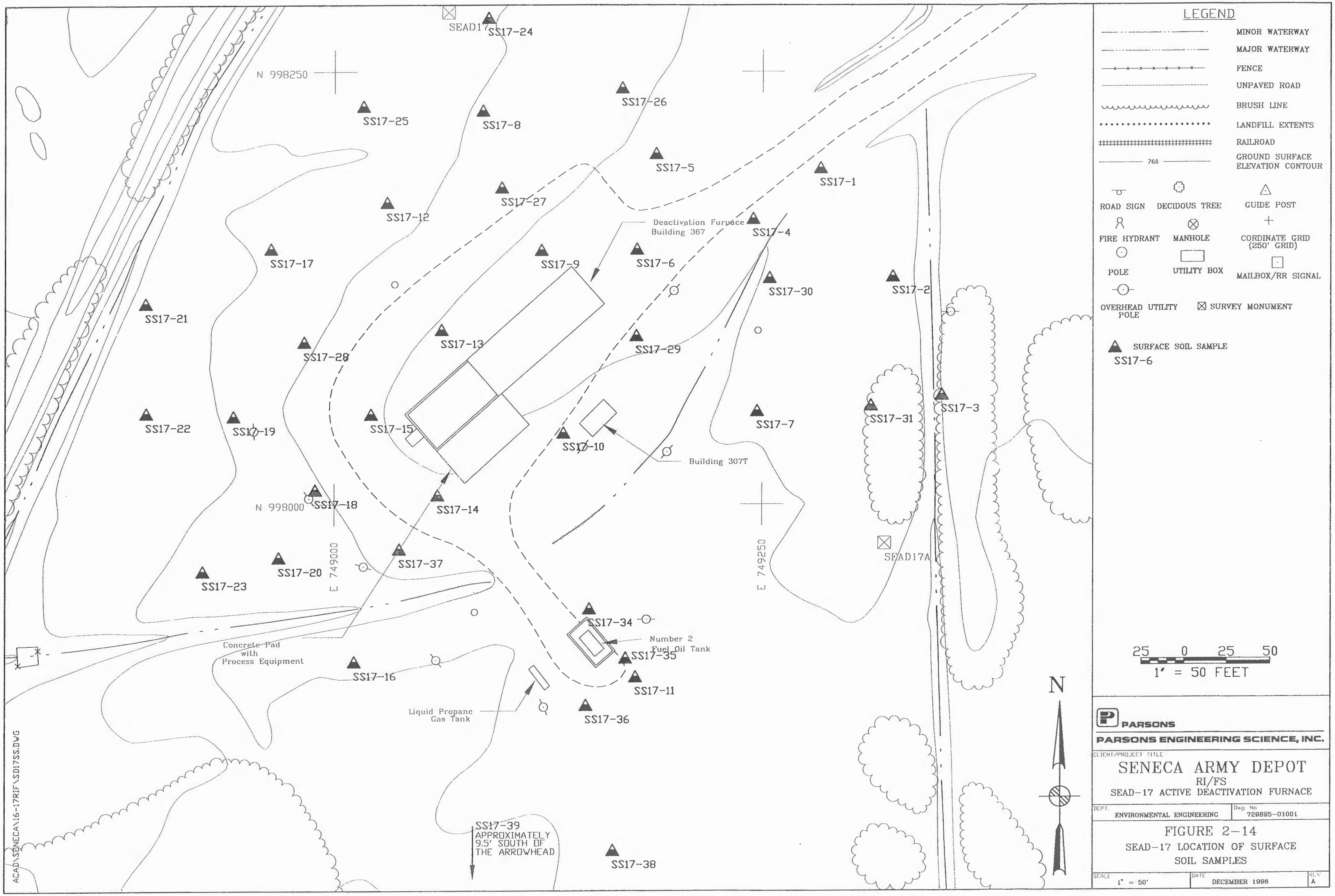
During the ESI phase, 24 surface soil samples (including a duplicate) were collected from locations around Building 367. The samples were collected in October and November 1993. The locations of the samples are shown in Figure 2-14. Surface soil sampling locations were determined to provide uniform coverage of the site. One of the samples, SS17-18, was obtained from the discharge point of the pipe that drains water from the retort inside the building. The surface soil samples were collected from the 0 to 2 inch depth (Table 2-11).

During the RI phase, the surface soil sampling program was designed to address the somewhat random impacts to surface soils as indicated by the ESI Report. Localized areas of higher concentrations in the northern area of the site adjacent to Building 367 were also evident. Because of the wide distribution of impacts to surface soils at the site, the proposed sampling program was designed to evaluate those areas with concentrations of metals and SVOCs in the surface soils. For the RI, surface soil samples (0 to 2 inches below the organic matter) were collected at 14 sample locations (SS17-24 to SS17-39) as presented in Table 2-11. These samples were collected in August 1996. As a note, sample numbers SS17-32 and SS17-33 were not used and do not show up on Table 2-11. Procedures for the collection of surface soil samples are provided in Section 2.2.4.2.

2.4.4.4 Downwind Surface Soil Samples

Fugitive dust emissions and stack emissions from SEAD-17 may have resulted in deposition of metals and SVOCs to surface soil downwind of the site. This includes the period during which the deactivation furnace was in operation (1962-1989) and the period following to the present. In order to access this transport and exposure pathway, surface soil samples were collected 500 feet from Building 367 in the two primary wind directions (Table 2-11). Samples were also collected 1,000 feet, 2,000 feet, 3,000 feet and 3,500 feet away from a point between SEAD-16 and SEAD-17 in the two primary wind directions. These samples are listed in Table 2-4. The primary wind directions at SEDA are to the north-northwest and the south-southeast.

The data gathered for the samples collected at 1,000 feet, 2,000 feet, 3,000 feet, and 3,500 feet along both sides of the downwind transect were used to assess the downwind transportation of contaminants for both SEAD-16 and SEAD-17. All of the downwind sample locations along the north-northwest/south-southeast azimuth and the wind rose used to determine the primary wind



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RI/FS
SEAD-17 ACTIVE DEACTIVATION FURNACE

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ENVIRONMENTAL ENGINEERING	729895-01001

FIGURE 2-14
SEAD-17 LOCATION OF SURFACE SOIL SAMPLES

SCALE	DATE	REV
1" = 50'	DECEMBER 1996	A

Table 2-11

SEAD-17 - Surface Soil Sampling Summary

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Surface Soil Location	Surface Soil Sample ID	Date Sampled	Sample Depth (ft)	
			Top	Bottom
SS17-1	SS17-1	10/21/93	0	0.17
SS17-2	SS17-2	10/21/93	0	0.17
SS17-3	SS17-3	10/21/93	0	0.17
SS17-4	SS17-4	10/21/93	0	0.17
SS17-5	SS17-5	10/21/93	0	0.17
SS17-6	SS17-6	10/21/93	0	0.17
SS17-7	SS17-7	10/21/93	0	0.17
SS17-8	SS17-8	10/21/93	0	0.17
SS17-9	SS17-9	10/20/93	0	0.17
SS17-10	SS17-10	11/09/93	0	0.17
SS17-11	SS17-11	11/09/93	0	0.17
SS17-12	SS17-12	10/21/93	0	0.17
SS17-13	SS17-13	10/20/93	0	0.17
SS17-14	SS17-14	10/21/93	0	0.17
SS17-15	SS17-15	10/20/93	0	0.17
SS17-16	SS17-16	10/21/93	0	0.17
SS17-17	SS17-17	10/21/93	0	0.17
SS17-18	SS17-18	10/22/93	0	0.17
SS17-18 (1)	SS17-24	10/22/93	0	0.17
SS17-19	SS17-19	10/21/93	0	0.17
SS17-20	SS17-20	10/21/93	0	0.17
SS17-21	SS17-21	10/21/93	0	0.17
SS17-22	SS17-22	10/21/93	0	0.17
SS17-23	SS17-23	10/21/93	0	0.17
SS17-24	16072	08/22/96	0	0.17
SS17-25	16073	08/22/96	0	0.17
SS17-26 (2)	16069	08/22/96	0	0.17
SS17-27	16063	08/21/96	0	0.17
SS17-28	16064	08/21/96	0	0.17
SS17-29	16065	08/21/96	0	0.17
SS17-30	16070	08/22/96	0	0.17
SS17-31	16071	08/22/96	0	0.17
SS17-34	16079	08/22/96	0	0.17
SS17-35	16078	08/22/96	0	0.17
SS17-36	16077	08/22/96	0	0.17
SS17-37 (2)	16080	08/22/96	0	0.17
SS17-38	16076	08/22/96	0	0.17
SS17-39	16075	08/22/96	0	0.17
500N	16081	08/22/96	0	0.17
1000S	16087	08/22/96	0	0.17
2000S	16085	08/22/96	0	0.17
3000S	16056	08/20/96	0	0.17
3500S	16055	08/20/96	0	0.17
500S	16082	08/22/96	0	0.17
1000N	16083	08/22/96	0	0.17
2000N	16089	08/22/96	0	0.17
2000N (3)	16090	08/22/96	0	0.17
3000N	16088	08/22/96	0	0.17
3500N	16084	08/22/96	0	0.17

Notes:
(1) Surface soil sample SS17-24 is a duplicate of SS17-18.
(2) Samples for TOC and grain size analyses were collected from this location.
(3) Sample 16090 is a duplicated sample of 16089 at location 2000N.

direction are shown in Figure 2-8. The wind rose data was gathered from SEDA and the Ithaca Airport in Ithaca, New York.

In summary, at SEAD-17, five samples were collected to the north-northwest of the site and five samples were collected to the south-southeast. These samples included two samples collected at 500 feet from SEAD-17 and eight samples along the downwind transects. All samples were collected from 0-2 inches below the surface organic material. Surface soil sample collection procedures are described in Section 2.2.4.2. The downwind surface soil samples were tested according to the analyses specified in Section 2.2.4.1.

2.4.5 Groundwater Investigation

2.4.5.1 Introduction

The purpose of the groundwater monitoring program at SEAD-17 was to define the horizontal and vertical extent of impacted groundwater, determine the directions of groundwater flow at the site, determine the hydrogeologic properties of the aquifer to assess chemical migration and potential remedial actions, determine whether the fuel oil storage tank has released any contaminants, and determine the background groundwater quality.

During the ESI, four monitoring wells were installed and the direction of groundwater flow was assumed to be to the west-southwest. These monitoring wells were screened in the saturated till/weathered overburden aquifer.

The results of the ESI groundwater investigation indicated that the groundwater was not significantly impacted by the site, although criteria exceedance were measured for five metals. Because the array of four wells installed during the ESI did not provide for complete coverage of the areas of concern at the site, one additional monitoring well was needed downgradient of the fuel storage tank to ensure that groundwater has not been impacted by contaminants that may have migrated from this area. As a result, a total of one new monitoring well (MW17-5) was installed for the RI. All five of these monitoring wells were screened in the till/weathered shale aquifer. In addition, physical characteristics of the till/weathered shale aquifer and the general groundwater flow conditions were investigated through measurements of depth to water and slug tests. The location of all monitoring wells is shown in Figure 2-13. Monitoring well construction details for all wells at SEAD-17 are presented in Table 2-12 and monitoring well completion diagrams are included in Appendix C.

Table 2-12

SEAD-17 - Monitoring Well Construction Details

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Well ID	Well Type (1)	Depth of Well Relative to Ground Surface (ft)	Depth of Well Relative to Top of PVC (ft)	Diameter of Boring (in)	Diameter of Well (in)	Well Screen Length (ft)	Screened Interval Relative to Ground Surface (ft)	Well Screen Slot Size (in)	Thickness of Bentonite Seal (ft)	Height of PVC Well Stickup (ft)	Elevation of Top of PVC Well (MSL)	Well Casing Material	Well Screen Material
MW17-1	T/WS	8.5	10.4	8.0	2.0	4.0	3.4 to 7.4	0.01	1.0	1.9	736.3	PVC	PVC
MW17-2	T/WS	6.0	8.1	8.0	2.0	2.0	3.3 to 5.3	0.01	0.3	2.1	733.8	PVC	PVC
MW17-3	T/WS	6.0	8.0	8.0	2.0	2.0	3.1 to 5.1	0.01	0.7	2.0	732.2	PVC	PVC
MW17-4	T/WS	6.0	8.1	8.0	2.0	2.0	3.1 to 5.1	0.01	0.7	2.1	734.6	PVC	PVC
MW17-5	T/WS	8.3	10.4	8.0	2.0	4.5	3.4 to 7.9	0.01	1.0	2.1	733.6	PVC	Wire-wrapped PVC

Notes:
(1) T/WS = Till Weathered Shale Aqufier

2.4.5.2 Monitoring Well Installation

During the ESI, four monitoring wells were installed at SEAD-17, one upgradient (MW17-1) for background water quality data and three downgradient of the site to determine the groundwater flow direction and determine if hazardous constituents have migrated from the site. Prior to the ESI, the presumed direction of groundwater flow at this site was to the west-southwest. The geophysical survey indicated that the direction was more to the west. Adjustments to the location of monitoring wells were based upon the seismic survey to assure wells were placed in upgradient and downgradient locations.

Monitoring well MW17-2 was located on the northwestern portion of the site downgradient of Building 367. Monitoring well MW17-3 was located downgradient of Building 367 while monitoring well MW17-4 was located downgradient of the area east of Building 367.

One monitoring well was constructed at each location and was screened over the entire thickness of the aquifer above competent bedrock.

During the RI, one overburden monitoring well (MW17-5) was installed. The well was located immediately downgradient of the fuel oil tank.

2.4.5.3 Monitoring Well Development

Subsequent to well installation, each monitoring well was developed to insure that a proper hydraulic connection existed between the borehole and the surrounding aquifer. The well development details for the ESI and the RI are summarized in Table 2-13 and the details of the procedure are presented in Section 2.2.5.2.

2.4.5.4 Groundwater Sampling

During the ESI, one groundwater sample was collected from each of the four monitoring wells following installation and development and analyzed for the parameters listed in Section 2.2.5.3. The monitoring wells were sampled using the procedure described in Section 2.2.5.3.

For the RI, groundwater samples were proposed to be collected from all 5 monitoring wells at SEAD-17 at two distinct times of the year, and analyzed for the parameters listed in Section 2.2.5.3. The first round of groundwater sampling was completed in August 1996. During the August 1996 event three of the wells were “dry” (MW17-2, MW17-3, and MW17-4) and thus

Table 2-13

SEAD-17 - Monitoring Well Development Information

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Well ID	Installation Date	Development Method	Field-Measured Parameters (1)				Gallons of Purge Water Removed	Well Volumes Removed
			Temperature (°C)	Specific Conductivity (umhos)	pH	Turbidity (NTU)		
MW17-1	12/01/93	Teflon Bailer & Pump	6.0	390	7.00	2.4	25.00	4.50
MW17-2	11/02/93	Teflon Bailer & Pump	9.6	600	6.50	1.7	19.50	5.00
MW17-3	11/30/93	Teflon Bailer & Pump	4.0	420	7.60	2.9	7.50	2.00
MW17-4	12/01/93	Teflon Bailer & Pump	3.0	355	7.56	8.3	12.00	3.00
MW17-5	08/13/96	Surge Block & Pump	19.7 (2)	35	6.84	7.9	22.00	10.30

Notes:
1) Measurements taken after well development completed.
(2) The monitoring well was developed during the summer resulting in a higher groundwater temperature.

could not be sampled. The second round of sampling was conducted in December 1996. Samples were collected from all five wells for this sampling round. However, results from the second round of groundwater sampling are not yet available from the laboratory. The wells were sampled using the latest version of the EPA groundwater sampling procedure, which is described in Section 2.2.5.3, and analyzed for the parameters listed in Section 2.2.5.2. The field sampling data are presented in Table 2-14.

2.4.6 Aquifer Testing

During the ESI, groundwater levels were measured at the four monitoring wells.

During the RI, three rounds of water level measurements were performed at all five monitoring wells. One round of measurements was conducted before well development and this measurement was used only for well development calculations. The second round of water level measurements was performed before the first round of groundwater sampling in August 1996. The final round of measurements were performed before the second round of groundwater sampling, which occurred in December of 1996. Data from the latter two rounds were used to construct groundwater topography maps.

Slug tests were performed during the RI at two of the five monitoring wells to determine hydraulic conductivities. Three monitoring wells (MW17-2, MW17-3, and MW17-4) had insufficient amounts of water to perform the test (i.e., the water table was below the bottom of the screen).. The data for both of these tests were collected using a transducer and data logger configuration. The slug test parameters and related information are shown in Table 2-15. The procedures for slug testing are provided in Section 2.2.6.2.

2.4.7 Surface Water and Sediment Investigation

The objectives of the surface water and sediment sampling program at SEAD-17 were to determine the nature and extent of impacts to on-site and off-site surface water and sediment, and to determine the background surface water and sediment quality. The results from the surface water and sediment sampling program were also be used to determine potential exposure levels for the risk assessment. The sampling program for surface water and sediment is summarized in Tables 2-16 . Sample locations are shown in Figure 2-15. Sampling procedures are described in Section 2.2.7.

No surface water or sediment samples were collected during the ESI.

03/03/99

Table 2-14

SEAD-17 - Monitoring Well Field Sampling Information (1)

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Well ID	Sample ID	Date Sampled	Field-Measured Parameters						Gallons of Purge Water Removed	Standing Water Volume (gal)	Well Volumes Removed
			Temperature (°C)	Specific Conductivity (umhos)	pH	Eh (millivolts)	Dissolved Oxygen (mg/L)	Turbidity (NTU)			
MW17-1	MW17-1-1	01/25/94	5.00	390	7.40	NA	NA	427.00	2.80	0.90	3.11
MW17-1	16108	08/29/96	18.8 (4)	766	7.00	338	7.1	11.90	4.90	0.42	11.67
MW17-1 (2)	16109	08/29/96	18.8 (4)	766	7.00	338	7.1	11.90	4.90	0.42	11.67
MW17-2	MW17-2-1	11/18/93	9.60	675	7.50	NA	NA	176.00	0.80	0.80	1.00
MW17-2 (3)	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW17-3	MW17-3-1	01/25/94	4.00	420	7.60	NA	NA	47.00	0.80	0.400	2.00
MW17-3 (3)	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW17-4	MW17-4-1	01/25/94	4.00	370	7.50	NA	NA	5.40	1.80	0.60	3.00
MW17-4 (3)	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW17-5	16106	08/29/96	17.2 (4)	734	6.90	319	0.28	21.30	5.50	0.53	10.38

Notes:
(1) Final measurements after well puring was completed.
(2) Sample 16109 is a duplicate of sample 16108 at MW17-1.
(3) NS = Not sampled. NA = Not available. There was an insufficient amount of standing water to sample.
(4) The monitoring well was sampled in the summer resulting in a higher groundwater temperature.

Table 2-15

SEAD-17-Data for Slug Test Hydraulic Conductivity Determinations

SEAD-16 & SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Well I.D.	Test Name	Well Type (1)	Depth to Bottom of Aquifer Relative to Top of PVC (2) (ft)	Well Point Relative to Top of PVC (ft) (3)	Screened Interval Relative to Top of PVC (ft)		Static Water Level Relative to Top of PVC (ft)	Initial Drawdown Relative to Top of PVC (ft)	Initial Drawdown Relative to static (ft) (2)	Internal Radius of Well Casing (ft) (2)	Effective Radius of Well Boring (ft) (2)	Saturated Thickness of Aqufer Static (ft) (2)	Screen Length - saturated (ft) (2)	Height of Water Column - Static (ft) (2)	Comments
MW17-1	MW171	T/WS	10.34	10.34	5.24	9.24	8.33	8.88	0.55	0.083	0.35	2.01	0.91	2.01	Data logger test
MW17-2	no test	T/WS	7.96	7.96	5.26	7.26	7.28	NA	NA	0.083	0.35	0.68	-0.02	0.68	Water below bottom of screen
MW17-3	no test	T/WS	7.80	7.80	4.90	6.90	7.16	NA	NA	0.083	0.35	0.64	-0.26	0.64	Water below bottom of screen
MW17-4	no test	T/WS	8.46	8.46	5.56	7.56	7.57	NA	NA	0.083	0.35	0.89	-0.01	0.89	Water below bottom of screen
MW17-5	MW175A	T/WS	10.24	10.24	5.34	9.84	7.36	7.78	0.42	0.083	0.33	2.88	2.48	2.88	Data logger test
MW17-5	MW175B	T/WS	10.24	10.24	5.34	9.84	7.44	7.94	0.50	0.083	0.33	2.80	2.40	2.80	Data logger test

Notes:
(1) T/WS = Till Weathered Shale Aqufier
(2) Input data to determine hydraulic conductivity with the AQTESOLV program.
(3) Well point depths may vary from those measured during well construction because sediments in the bottom of the well are removed during well development.

Table 2-16

SEAD-17 - Surface Water and Sediment Sampling Summary

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Surface Water and Sediment Sampling Location	Surface Water Sample ID	Sediment Sample ID	Date Sampled	Sediment Sample Depth (in)	Surface Water Field-Measured Parameters				
					Temperature (°C)	pH	Specific Conductivity (umhos)	Dissolved Oxygen (mg/L)	Turbidity (NTU)
SW/SD17-1	16120	16120A	09/17/96	0 to 6	17.0	7.8	239	NA	5.50
SW/SD17-2	16130	16130A	09/18/96	0 to 6	20.6	6.2	273	NA	1.17
SW/SD17-3	16131	16131A	09/18/96	0 to 6	21.0	6	384	NA	1.63
SW/SD17-4	16136	16136A	09/18/96	0 to 6	17.2	5.85	410	NA	1.45
SW/SD17-5	16137	16137A	09/18/96	0 to 6	17.7	6.11	403	NA	1.29
SW/SD17-6	16121	16121A	09/18/96	0 to 6	17.8	6.08	402	NA	1.65
SW/SD17-7	16132	16132A	09/18/96	0 to 6	19.0	6	240	NA	2.34
SW/SD17-8	16124	16124A	09/17/96	0 to 6	16.8	8.05	165	NA	0.60
SW/SD17-9	16122	16122A	09/17/96	0 to 6	17.2	8.2	180	NA	1.59
SW/SD17-10	16123	16123A	09/17/96	0 to 6	13.0	7.82	217	NA	1.71

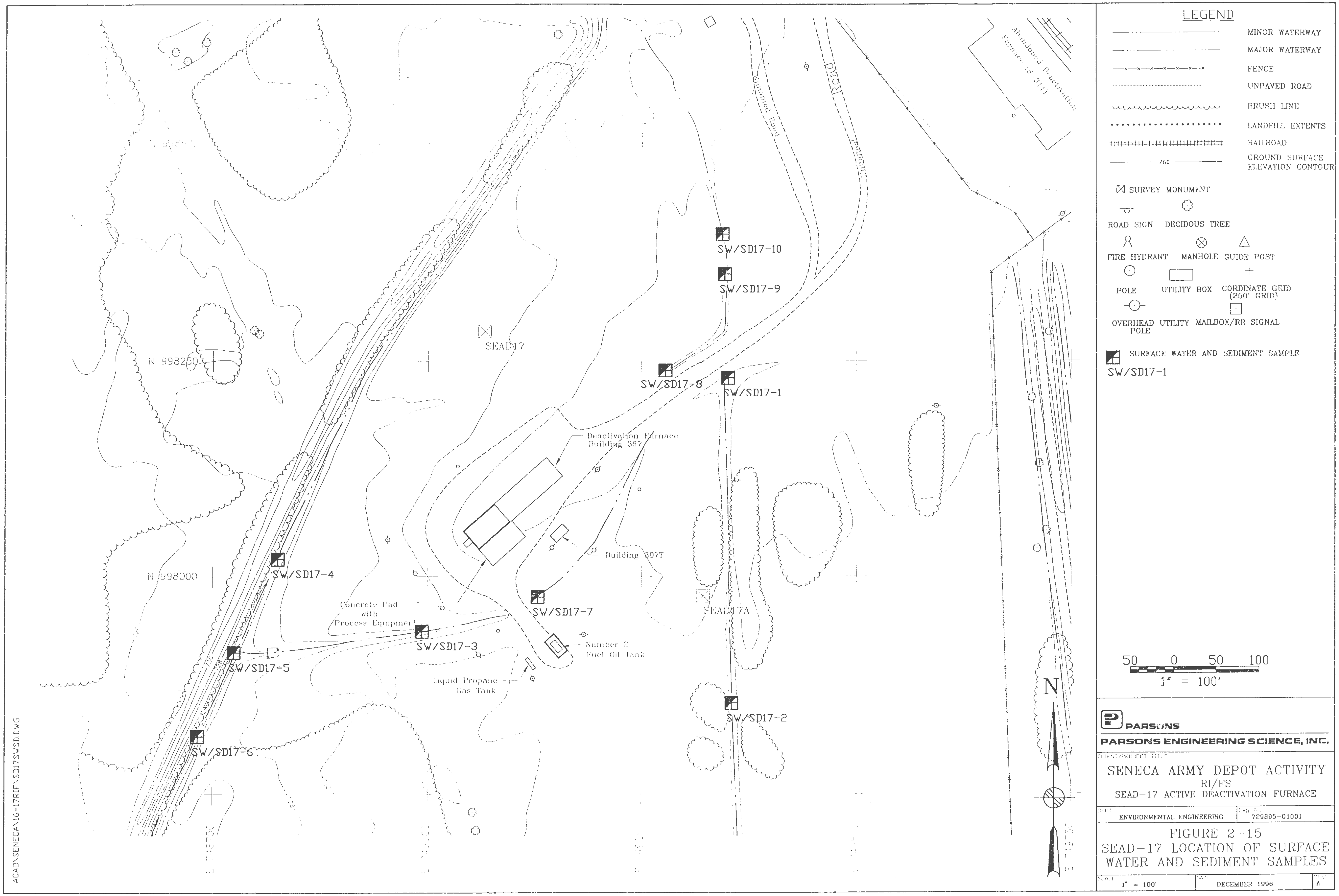

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FIGURE 2-15
SEAD-17 LOCATION OF SURFACE WATER AND SEDIMENT SAMPLES

SCALE 1" = 100'

DATE DECEMBER 1996

REV A

During the RI, a total of ten surface water and sediment samples were collected on or near the site. Surface water and sediment sample pairs were collected from the same location. Three samples (SW/SD17-8, SW/SD17-9, and SW/SD17-10) were collected from the drainage ditch at the northeastern portion of the site. Two samples (SW/SD17-1 and SW/SD17-2) were collected from the drainage ditch located along the eastern portion of the site, and flowing south. One sample (SW/SD17-7) was obtained from a drainage channel located 50 feet south of Building 367. Four samples (SW/SD17-3, SW/SD17-4, SW/SD17-5, and SW/SD17-6) were collected in the drainage ditch located at the southwestern portion of the site.

Surface water and sediment sampling occurred during and immediately after a rainstorm when there was water in the drainage channels. This information was used to delineate the extent of chemical impacts on-site and identify whether chemicals have migrated off-site.

2.4.8 Ecological Investigation

An important component in establishing the environmental risk associated with a hazardous waste site is to identify the potential impacts to the on-site and off-site aquatic and terrestrial communities. The overall objectives of this ecological investigation program were to characterize the existing aquatic and terrestrial biotic environment on and near SEAD-17, to delineate any wetlands in and around SEAD-17, and to perform an ecological assessment to systematically document visual observations discriminating between obviously and potentially impacted and non-impacted areas. This final objective will determine if there is a need for further ecological investigations..

The ecological assessment included the development of a site description that addressed existing environmental conditions, and the characterization of local ecological resources. The ecological assessment followed the requirements outline as Step I and Step IIA of the NYSDEC Division of Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites. The requirements are discussed in more detail in Section 2.2.8. No biological sample collection or inventory was conducted for the Step I FWIA. Multiple site visits were conducted during the fall of 1996 to evaluate the habitat conditions within the radius of concern of SEAD-17. A general vegetative convertype map was prepared within a 2-mile radius of the site as shown in Figure 2-16. A more detailed vegetative covertype map of the one-half mile radius was also prepared and is shown in Figure 2-17.

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FIGURE 2-16
STUDY AREA FOR SIGNIFICANT NATURAL RESOURCES WITHIN 2.0 MILES OF SEAD-17

1" = 2000'
JANUARY 1997
A

ACAD\SENECA\25-26RIF\SD1705SA.DWG

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FIGURE 2-17
STUDY AREA FOR SIGNIFICANT NATURAL RESOURCES WITHIN 0.5 MILES OF SEAD-17

SCALE	DATE	REV
1" = 500'	JANUARY 1997	A

3.0 DETAILED SITE DESCRIPTION

3.1 SEAD-16

3.1.1 Site Features

The Abandoned Deactivation Furnace (Building S-311) is located in the east-central portion of SEDA and situated on approximately 2.6-acres of fenced land. Directly to the northwest of Building S-311 and separated by two sets of SEDA railroad tracks which pass through the site, is a smaller abandoned building, the Process Support Building (Building 366) (Figure 1-3). The entire site is enclosed by a chain-link fence with three gates and access to the area is restricted. The site is composed of grasslands to the north, east, and west and by a general storage area for empty boxes and wooden debris and an unpaved roadway to the south. Railroad tracks transect the site in a north-south direction. Two sets of tracks parallel Building S-311 on the northeastern side and a spur runs to the loading dock on the northwestern corner. Vehicle access to Building S-311 is provided via an unpaved road that intersects Administration Avenue 1,500 feet east of the site.

SEAD-17 is located approximately 800 feet southwest of SEAD-16. A Steam Generation Building (Building 310) is located approximately 160 feet north of the site beyond the chain-link fence.

The Abandoned Deactivation Furnace is an elongated building with two emission stacks located on the eastern and western ends (Figure 1-2). The stack on the western end was used for boiler emissions and the stack on the eastern end was used for furnace emissions. Building S-311 is composed of several rooms. The deactivation furnace was located in the southeastern end of the building. Also, two boilers are located in the southeastern corner of the building. Generally, the building is in poor condition and there is localized flooding in the basement. A sloping concrete ramp leads to the base of the building on the southeastern corner, and it is likely that the surface water in the basement of Building S-311 entered via this sloping ramp. The building is surrounded by loading docks on the southwestern and northwestern sides.

Two underground storage tanks (USTs) formerly existed at Building S-311. Tank 311-A UST was located to the northwest of the building and provided #2 fuel oil to the boiler that was used to heat the building. It had a capacity of 1,000 gallons and was installed in 1953. Tank 311-B was located to the southwest of the building and provided #2 fuel oil to the deactivation furnace. It had a 2,000-

gallon capacity and was also installed in 1953. Both of the tanks were removed in September of 1992. The removal report is contained in Appendix A.

The Process Support Building (Building 366), which was used for propellant/powder collection, is composed mostly of corrugated sheet metal (southern end) and brick (northern end). It consists of a long hallway (approximately 103 feet) with two rooms adjacent to its southern end and a small concrete vault at the northern end. The southernmost room contains a Hoffman Vacuum Sweeping System and a Hoffman Vacuum Dust Remover, which is a wet-type explosive separator. The second room, which is located just north of the first room, contains two receiving vats that are believed to have received propellant/powder materials through a pipeline from Building S-311. The northern end of the hallway is made of brick and is connected to a concrete vault. This concrete vault was used to store propellant containers.

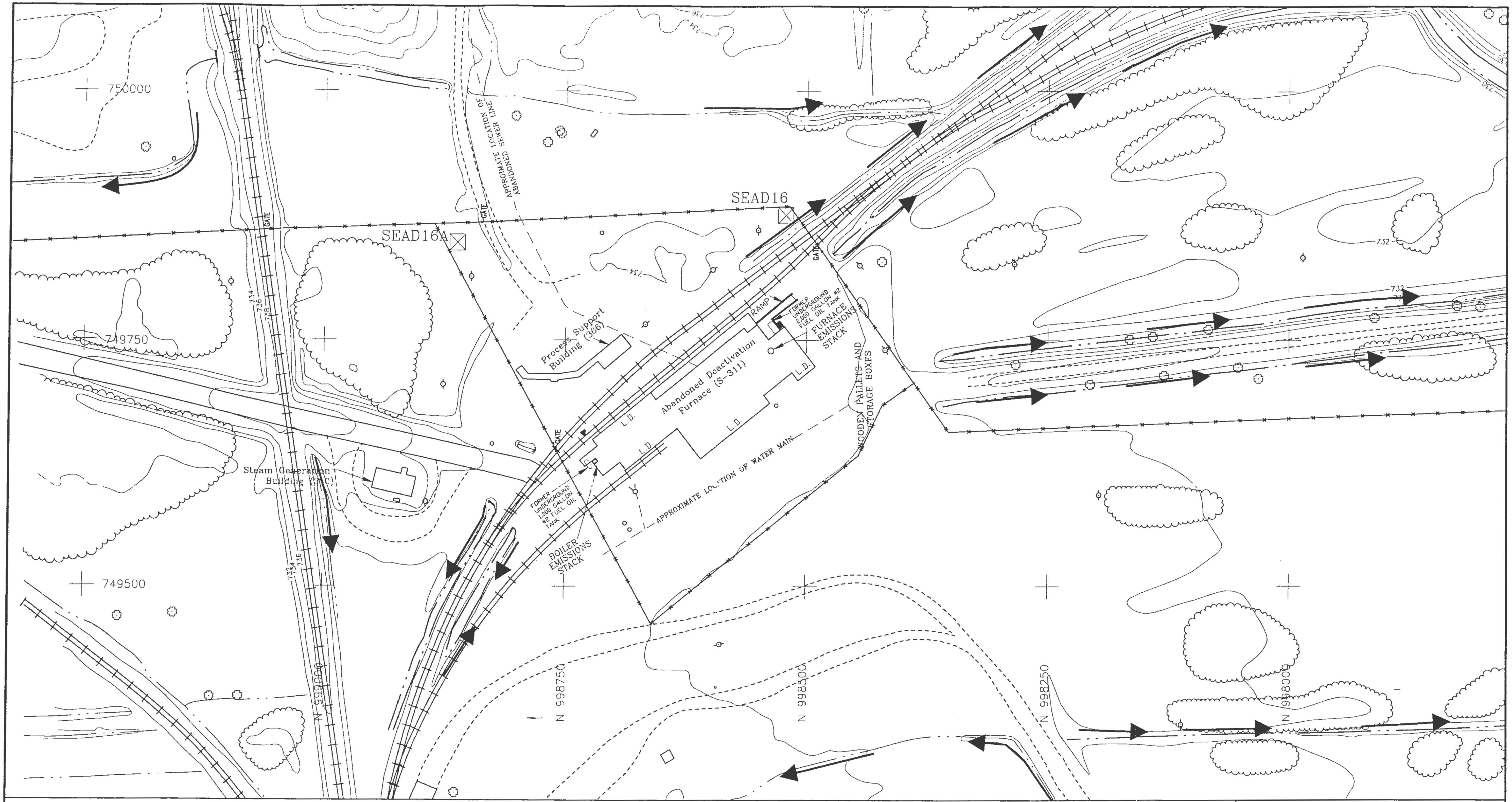
Utilities on the site include a buried water main, an abandoned sewer line, and overhead utilities for electricity. The water main traverses the southwestern portion of the site with a service line leading to the northwestern side of Building S-311. The abandoned sewer line enters the site from the northeast, approximately 50 feet south of the access gate, and connects to the central portion of Building S-311. Along the western side of the site, a series of utility poles carry electric lines to the two buildings.

3.1.2 Topography

The Abandoned Deactivation Furnace is located on a relatively flat part of the facility in the eastern portion of SEDA. Ground surface elevations on the site are generally between 732 and 743 feet above msl. The northeastern portion of the site is vegetated with low grass and the southwestern portion is paved with asphalt. There is little topographic relief on the site and no water bodies exist on-site. Surface water run-off is directed off-site to the southeast and northwest by small drainage swales.

3.1.3 Surface Water

Surface water flow from precipitation events is controlled by local topography, although there is little topographic relief on the site. In the grass-covered eastern portion of the site, surface water likely accumulates in local topographic low areas. The presumed directions of surface water runoff at the site are shown in Figure 3-1. Near the survey monuments SEAD16 and SEAD16-A, surface water is directed off-site to the southeast and northwest, respectively, via small drainage swales. In



ACAD\SENECA\16-17RIF\SD16SWFD.DWG

LEGEND

- MINOR WATERWAY
- MAJOR WATERWAY
- FENCE
- UNPAVED ROAD
- BRUSH LINE
- LANDFILL EXTENTS
- RAILROAD
- GROUND SURFACE ELEVATION CONTOUR (760)

- ☒ SURVEY MONUMENT
- ROAD SIGN
- DECIDOUS TREE
- FIRE HYDRANT
- ⊗ MANHOLE
- △ GUIDE POST
- ○ POLE
- UTILITY BOX
- + CORDINATE GRID (250' GRID)
- OVERHEAD UTILITY POLE
- ☐ MAILBOX/RR SIGNAL
- L.D. LOADING DOCK
- ← DIRECTION OF SURFACE WATER FLOW

50 0 50 100
1" = 100'

N

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FIGURE 3-1
SEAD-16 SURFACE WATER RUNOFF DIRECTIONS

SCALE 1" = 100'
DATE DECEMBER 1996
REV A

the paved western portion of the site, the asphalt is a relatively impermeable surface that results in an increased amount of surface water runoff in this portion of the site. Based on topographic expression, surface water flow on the asphalt is to the west. There are no sustained surface water bodies on-site.

Outside the chain-link fence that surrounds SEAD-16, three sets of well-defined drainage ditches are potential flow pathways overland flow from the site. Two ditches parallel the rail road tracks southeast of the site. Two smaller ditches are present where these tracks exit the site to the northwest. Beyond the southern extent of the chain-link fence, two additional drainage ditches drain due south.

Precipitation data from the Aurora Research Farm monitoring station, were reviewed to gain a perspective on the seasonal variations in rainfall that would directly impact surface water flow. These data indicate that, historically, June has the greatest amount of rainfall at 3.9 inches, and the winter months of January and February generally have had the least amount of rainfall. These data are shown in Figure 1-14.

3.1.4 Site Geology

3.1.4.1 Introduction

The site geology is characterized by gray Devonian shale with a thin weathered zone where it contacts the overlying mantle of Pleistocene till. This stratigraphy is consistent over the entire site. Additionally, artificial fill occurs above the till at locations around the buildings on the site. Boring logs for SEAD-16 are presented in Appendix B.

3.1.4.2 Till

The predominant surficial geologic unit present at the site is dense till. The till is distributed across the entire site and ranges in thickness from 0.5 feet to as much as 3.0 feet based upon refusal data collected during the ESI and RI, although the average thickness of the till on-site is only 1.7 feet. The thickest section of glacial till was encountered at soil borings MW16-1, which is located in the northeastern portion of the site. The thinnest section of till was found at MW16-6, which is adjacent to the northern part of building S-311, while till was entirely absent at locations SB16-3, MW16-2, and MW16-3. The till is generally characterized by brown to olive-gray silt and clay, trace of fine sand with few fine to coarse gravel-sized inclusions of weathered shale. It has been shown on other areas of SEDA that larger diameter weathered shale clasts are more prevalent in basal portions of the till and are probably ripped-up clasts removed by the once-active glacier, however, at SEAD-16 this occurence was not well documented. The general Unified Soil Classification System description of the till on-site is as follows: Clay-silt, brown to olive-gray, slightly plastic, small percentage of fine to medium sand, small percentage of fine to coarse gravel-sized gray shale clasts, dense and mostly dry in place, till, (ML).

Darian silt-loam soils, 0 to 18 inches thick, are developed in till derived mainly from local alkaline and calcareous, dark-gray and black silty shale and a small quantity of limestone (Hutton, 1972). These surficial soils are somewhat poorly drained and have a silt clay loam and clay subsoil. These are nearly level to gently sloping soils that have developed on the uplands in the central part of Seneca County. In general, 0-3 percent slopes are associated with these soils (Hutton, 1972).

Grain size analyses were performed on surface soils that were sampled as part of the surface soil sampling program. Grain size analyses were performed on three soil samples collected from varying depths in soil borings SB16-2 and SB16-5 at SEAD-16 (Appendix D). A till sample collected from 1 to 2 feet in boring SB16-2 contained 27 percent silt and clay. A fill sample collected form the same depth at boring SB16-5 contained approximately the same percentage of silt and clay. A till sample at 2 to 3.3 in SB16-5 contained considerable more silt and clay, 66 percent.

Grain size analysis curves for till samples collected during the installation of monitoring wells on another portion of SEDA show a wide distribution of sediment sizes (Metcalf & Eddy, 1989). Based on all of the available grain size analyses at SEDA, the till generally has a high percentage of silt and clay with lesser amounts of sand and fine gravel-sized particles (47 to 93 percent of the sample passed the no. 200 sieve). The porosities of five gray-brown silty clay (i.e., till) samples ranged from 34.0 percent to 44.2 percent with an average of 37.3 percent (USAEHA, 1985).

These grain size data are approximately consistent with data published by the Soil Conservation Service (Hutton, 1972) which show that Darian Series (DaA) soils in Seneca County contain between 55 and 75 percent silt and clay (i.e., this percentage passes the no. 200 sieve).

The minimum, maximum and average background concentrations of selected inorganic constituents in the till located on SEDA have been extensively characterized. These data are discussed in Section 1.0 and presented in Table 1-2.

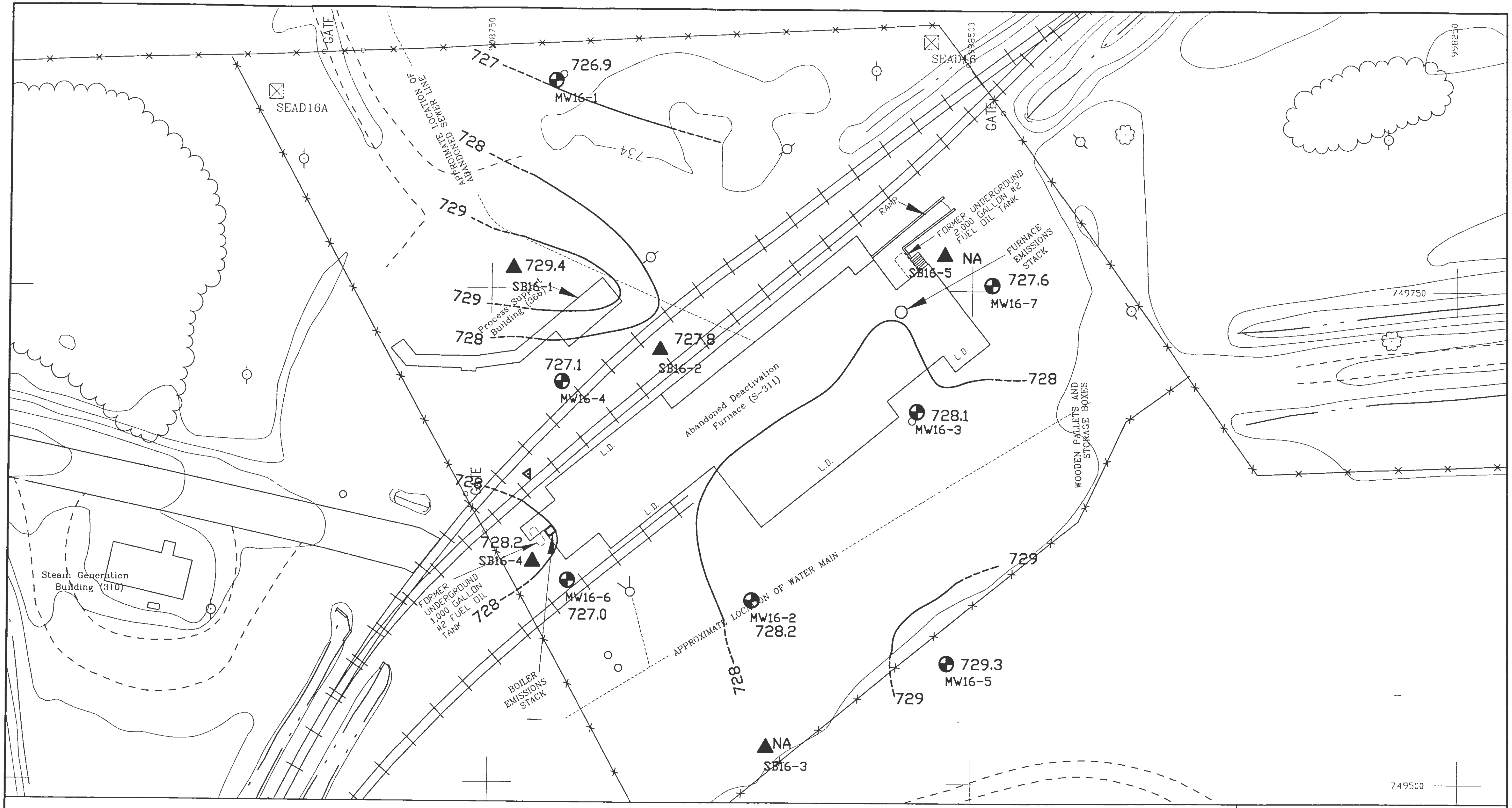
3.1.4.3 Weathered Shale

A zone of gray weathered shale of variable thickness was encountered below the till at all of the locations drilled on-site. This zone is characterized by fissile shale with a large amount of brown interstitial silt and clay. The upper boundary of the weathered shale was recorded in split spoon samples and the base of the weathered shale was, for the purposes of this investigation, defined as the depth of refusal with the hollow stem augers or where augering became abruptly difficult and slow. The thickness of the weathered shale ranges between 0.2 feet (at SB16-1) to 2.7 feet (at MW16-5) on the site. The average thickness on the site is 1.5 feet. Differential weathering through geologic time is likely responsible for the variable thickness. No outcrops of weathered or competent shale are exposed at SEAD-16.

3.1.4.4 Competent Shale

No bedrock coring was performed at SEAD-16, however, information on the competent shale is available from Mozola (1951) and cores obtained from other sites at SEDA. The bedrock underlying the site is composed of the Moscow Formation of the Devonian age Hamilton Group, according to the Geologic Map of New York, Finger Lakes Sheet (1970). Specifically, the site lies in the lower one-quarter of the Moscow Formation. The lower two thirds of the Moscow shale is a soft, gray, and calcareous and contains an abundance of fossils (Mozola, 1951). The upper or younger part of the Moscow shale is dark, highly friable, and less calcareous than the lower two-thirds. Weathered surfaces are generally medium to light gray and may be stained with iron oxide. Many of the joint openings in the shale strike in two predominant joint directions, N 65° E and N 25-30° W (Mozola, 1951). These joints are primarily vertical. Merrin (1992) cites three prominent vertical joint directions of northeast, north-northwest, and east-northeast in outcrops of the Genesse Formation 15 miles southeast of SEAD-25 near Ithaca, New York. The Hamilton Group is a gray-black, calcareous shale that is fissile and exhibits parting (or separation) along bedding planes.

Gray competent shale was encountered between 3.1 feet and 6.0 feet below the land surface in the borings performed at SEAD-16. A bedrock topographic map was developed based upon hollow stem auger refusal depths of these soil borings, and upon visual observations made by the drilling supervisors. In all instances, auger refusal was considered to be the top of the competent shale. The bedrock topographic map is presented in Figure 3-2. Generally, the stratigraphic data indicate that the bedrock surface undulates over the entire site with a total relief of less than 2.5 feet; it does not form a gentle west-sloping surface as one might expect from the regional land surface topography. The bedrock topography is at a maximum elevation (over 729 feet msl) in two areas



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LEGEND

MINOR WATERWAY	
MAJOR WATERWAY	
FENCE	
UNPAVED ROAD	
BRUSH LINE	
LANDFILL EXTENTS	
RAILROAD	
GROUND SURFACE ELEVATION CONTOUR	760

☒ SURVEY MONUMENT

L.D. LOADING DOCK

ROAD SIGN

DECIDOUS TREE

FIRE HYDRANT

MANHOLE

GUIDE POST

POLE

UTILITY BOX

CORDINATE GRID (250' GRID)

OVERHEAD UTILITY POLE

MAILBOX/RR SIGNAL

▲ 729.8 SB16-4 SOIL BORING WITH ELEVATION OF TOP OF COMPETENT SHALE

729.8 MW16-7 MONITORING WELL WITH ELEVATION OF TOP OF COMPETENT SHALE

COMPETENT SHALE CONTOUR LINE (DASHED WHERE INFERRED)

NA NOT AVAILABLE

25 0 25 50

1' = 50'

N

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FIGURE 3-2
SEAD-16 COMPETENT SHALE
TOPOGRAPHY MAP

SCALE 1" = 50'

DATE DECEMBER 1996

REV A

on the site (Figure 3-2). One of these areas is in the southwestern portion of the site and another smaller area is in the northeastern portion of the site. The surface of the bedrock seems to reflect the surface topography on the site, which exhibits little relief with elevations generally between 732 feet and 734 feet msl, except in the far eastern portion where surface elevations above 734 feet msl are mapped.

3.1.4.5 Filled Areas

Based on data from the boring logs, a thin layer of fill covers many areas of the site. The fill becomes significantly thicker near the Abandoned Deactivation Furnace (Building S-311) where it comprises the majority of the unconsolidated subsurface material. The fill near the building is believed to be associated with the construction of Building S-311.

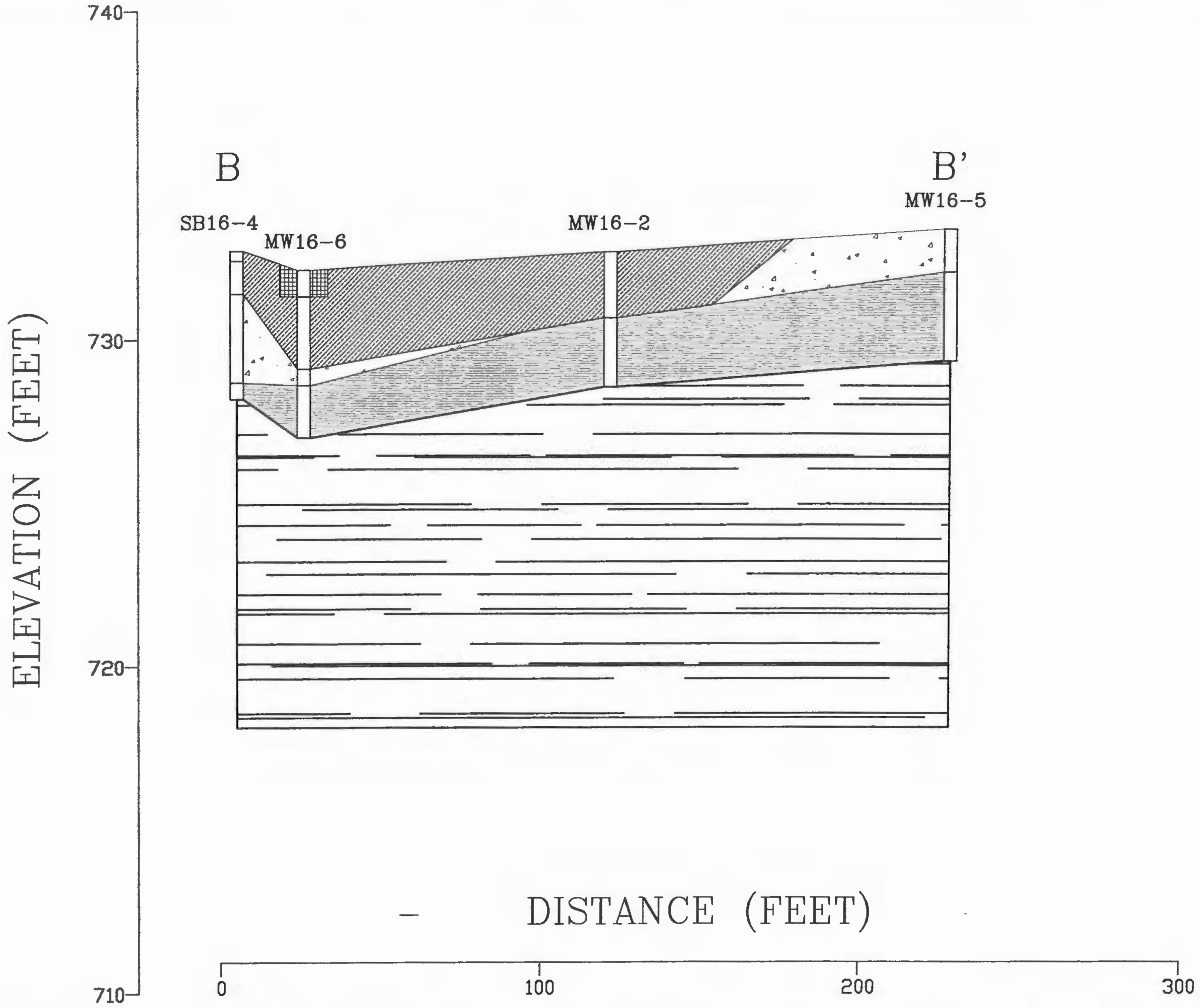
3.1.4.6 Site Stratigraphy

Two geologic cross-sections were constructed for the site. The locations of these sections are shown in Figure 3-3. Cross-sections A-A' and B-B' show the consistent till, weathered shale, competent shale stratigraphy beneath the site based on data from borings and monitoring wells (Figures 3-4 and 3-5). Also, both cross-sections show the presence of fill near Building S-311. The sections were drawn to provide a somewhat detailed view of the subsurface stratigraphy by intersecting as many data points (i.e., soil borings or monitoring wells) as possible while maintaining a uniform direction for the cross-section.

3.1.5 Geophysics

3.1.5.1 Seismic Refraction Survey

Prior to beginning any subsurface investigations, a seismic refraction survey was performed along four profiles at SEAD-16. The results of the seismic refraction survey conducted in SEAD-16 are listed in Table 3-1. The locations of the individual seismic transects are shown in Figure 2-1. The seismic survey detected 2 feet to 8.5 feet of till, which is characterized by a 1,200 ft/s to 3,500 ft/s travel time, that was overlying bedrock, which in turn was characterized by a 11,500 ft/s to 13,000 ft/s travel time. Saturated till was not detected at the time of the survey. Possible explanations as to why the water table was not detected are that the water table was situated within the bedrock, or the thickness of saturated till was small (less than 2 feet) and was not detectable by the seismic survey.



▨ FILL

▒ WEATHERED SHALE

▦ CONCRETE

∴ GLACIAL TILL

☰ COMPETENT SHALE

HORIZONTAL SCALE – 1" = 40'
VERTICAL EXAGERATION = 10X
BUILDING VERTICAL SCALE IS ESTIMATED

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FIGURE 3-5
SEAD-16 GEOLOGIC CROSS-SECTION
B-B'

SCALE AS NOTED
DATE JANUARY 1997
REV A

Table 3-1

SEAD-16 - Results of Seismic Refraction Survey

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Profile Number	Distance[1] on Profile (feet)	Ground Elevation[2] (feet)	Bedrock	
			Depth (feet)	Elevation (feet)
P1	0	100.0	3.0	97.0
	57.5	100.0	6.0	94.0
	115	99.7	7.3	92.4
P2	0	99.5	5.5	94.0
	57.5	99.7	2.3	97.4
	115	100.2	3.2	97.0
P3	0	99.0	4.1	94.9
	57.5	99.0	4.2	94.8
	115	99.0	4.2	94.8
P4	0	99.3	6.5	92.8
	57.5	100.1	8.5	91.6
	115	100.6	4.9	95.7

Notes:

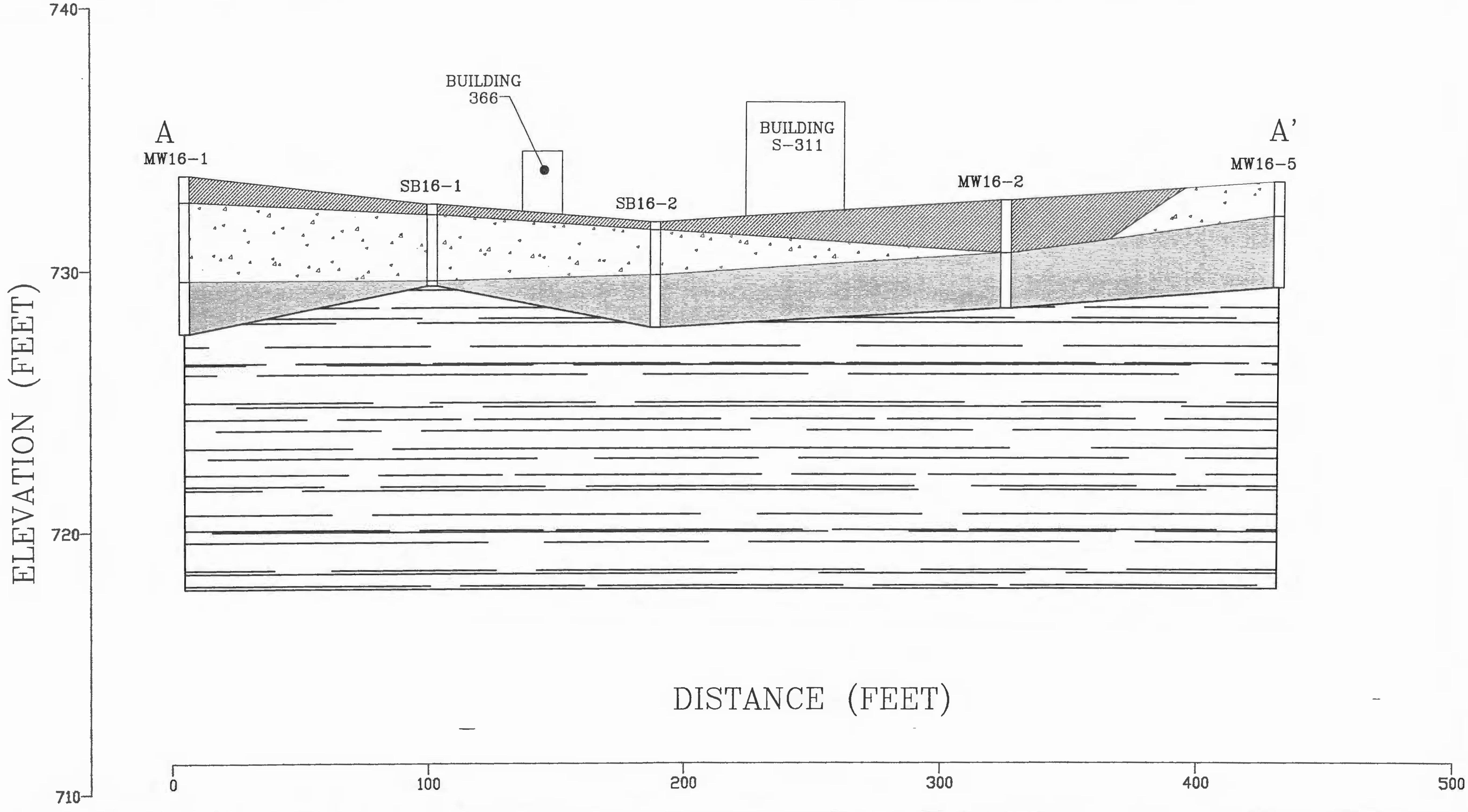
[1] All distances are in feet.

[2] All elevations are relative to a temporary benchmark and are in feet.

A groundwater contour map was prepared using the August 27, 1996 data set, and it clearly indicates that groundwater flow is not in a single direction nor is it well defined on the site (Figure 3-6); the contour interval is 0.25 feet. Note that the groundwater contours in the north-central portion of the site were drawn with consideration given to the likely influence of a local bedrock high (>729 ft msl) between wells MW16-1 and MW16-4; the bedrock data is based on information from soil boring SB16-1. This map indicates that groundwater flow directions are to the north and northeast over most of the site, however, there is a southwestly component of flow in the southwestern portion of the site. Groundwater elevations range from a high of 730.06 feet immediately southwest of Building S-311 to a low of 729.02 feet in the northeastern portion of the site. The maximum relief over the entire site is 1.04 feet. Saturated thicknesses for the aquifer at SEAD-16 were between 0.5 feet and 2.2 feet, values that are significantly less than those measured in April 1994, especially at MW16-1. Based on groundwater elevation data from other sites at SEDA (i.e., the Ash Landfill), the late summer and early fall is typically a time when the saturated thickness of the till/weathered shale aquifer is smallest for the year. In the northeastern portion of the site, the horizontal groundwater gradient was calculated to be 0.004 ft/ft between wells MW16-1 and MW16-3, however, the flow direction was to the northeast, which is opposite to that indicated by the April 1994 data. On another portion of the site, the gradient between MW16-2 and MW16-6 was calculated to be 0.01 ft/ft and groundwater flow is to the north.

A second groundwater contour map was constructed based on depth to water measurements made on December 6, 1996 (Figure 3-7). This map indicates that groundwater flow directions are gernerally toward Building S-311 in the central portion of the site at this time of year. These two flows are believed to coalesce near the central portion of the site and flow to the west following the regional slope of the land surface. Groundwater elevations are at a high of approximately 732 feet in the southwestern and northeastern portions of the site, and the lowest elevation is believed to occur near MW16-6 at the northwest side of Building S-311. The maximum relief of the water table over the site is 2.2 feet. Saturated thicknesses for the aquifer at SEAD-16 were between 2.6 feet and 5.4 feet, values that are significantly greater thant those measured in August 1996. The horizontal groundwater gradient was calculated to be 0.009 ft/ft in the northeastern porton of the site (between wells MW16-1 and MW16-4, and the flow direction was to the southwest. On another portion of the site, the gradient between MW16-2 and MW16-6 was calculated to be 0.01 ft/ft and groundwater flow was to the northeast.

It is noteworthy that at SEAD-16 there is no sustained/well-defined direction of groundwater flow or groundwater gradient based on the groundwater topography maps that depict the late summer water table conditions (i.e., August 27, 1996) and winter water table conditions (December 6,



▨ FILL

⁘ GLACIAL TILL

▒ WEATHERED SHALE

☰ COMPETENT SHALE

HORIZONTAL SCALE – 1" = 40'
VERTICAL EXAGERATION = 10X
BUILDING VERTICAL SCALE IS ESTIMATED

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FIGURE 3-4
SEAD-16 GEOLOGIC CROSS-SECTION
A-A'

SCALE AS NOTED
DATE JANUARY 1997
REV A

Table 3-3

SEAD-16 - Hydraulic Conductivity (K) Values for the Till/Weathered Shale Aquifer

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Location ID	Test Name	K (cm/sec)	K (ft/day)
MW16-1	MW161	6.77E-03	1.92E+01
MW16-2	MW162	2.47E-02	7.00E+01
MW16-3	MW163A	9.81E-03	2.78E+01
MW16-3	MW163B	1.10E-02	3.12E+01
MW16-4	MW164A	3.55E-03	1.01E+01
MW16-4	MW164B	2.84E-03	8.04E+00
MW16-5	no test (1)		
MW16-6	MW166	4.82E-03	1.37E+01
MW16-7	MW167	9.07E-03	2.57E+01
Summary Information:			
	Maximum:	2.47E-02	7.00E+01
	Minimum:	2.84E-03	8.04E+00
	Geometric Mean:	7.29E-03	2.07E+01
	Median:	7.92E-03	2.24E+01

Note:
(1) No test was performed because the water table was below the bottom of the well screen.
NA = Not Available

hydraulic conductivity, an estimated effective porosity, and measured on-site groundwater gradients. A porosity estimate for weathered fissile shale with large amounts of silt in the interstices could not be located in the literature. Therefore, effective porosities for the till of 15 percent to 20 percent were used in the calculations.

It is noteworthy that at SEAD-16 there is no well defined direction of groundwater flow or groundwater gradient that is maintained throughout the year based on the groundwater topography maps discussed above for August 1996 and December 1996. Thus, velocities were calculated for both water table conditions.

The average linear velocity of groundwater in the till/weathered shale aquifer was calculated using the method described by Darcy's Law. The Darcy equation for the average linear velocity (*V*) of groundwater flow (Freeze and Cherry 1979) is:

$$V = \frac{K \frac{dh}{dl}}{n}$$

where:

K is the horizontal hydraulic conductivity (cm/sec);
n is the estimated effective porosity (percent); and
dh/dl is the hydraulic gradient (ft/ft).

For the calculation of the groundwater flow velocity in December 1996 the input values used in the equation were: 1) a hydraulic conductivity of 7.3×10^{-3} cm/sec (20.7 ft/day), 2) an effective porosity of 15 percent (0.15) to 20 percent (0.20), and 3) a groundwater gradient of 0.009 ft/ft (between wells MW16-1 and MW16-4). Total porosities for till samples from another location at SEDA ranged from 34.0 percent to 44.2 percent with an average of 37.3 percent. Therefore, an effective porosity of 15 percent to 20 percent was determined to be reasonable. Substituting the above-referenced values into the Darcy equation yields an average linear velocity of 0.93 feet/day (or 340 feet/year) at 20 percent effective porosity, and 1.2 feet/day (or 453 feet/year) at 15 percent effective porosity.

To calculate the groundwater flow velocity between well MW16-1 and MW16-3 for August 1996 the same input parameter values were used as noted above, except for the groundwater gradient (0.004 ft/ft was used), and the direction of groundwater flow was to the northeast and not the southwest. By substituting into the above-reference equation, the groundwater velocity was calculated to be 0.41 ft/day (or 151 ft/year) at 20 percent effective porosity, and 0.55 feet/day (or 201 feet/year) at 15 percent porosity.

Also, for the August 1996 data, another groundwater velocity was calculated for a different area of the site. For this calculation a gradient of 0.01 ft/ft between wells MW16-2 and MW16-6 was used and the hydraulic conductivity and effective porosity remained the same. Substituting the above-referenced values into the Darcy equation yields an average linear velocity of 1.0 feet/day (or 365 ft/year) at 20 percent effective porosity, and 1.4 feet/day (or 511 feet/year) at 15 percent effective porosity.

Based on the discussion above, it is important to note that the highly variable nature of the saturated thicknesses of the till/weathered shale aquifer may result in varying degrees of influence from the local bedrock topography on the direction and velocity of groundwater flow throughout the year. Thus, the calculated groundwater velocities are not likely to be sustained. Therefore, the actual direction and distance of groundwater flow as indicated by the calculated velocities are likely to vary throughout the year.

3.1.7 Ecological Investigation

3.1.7.1 Introduction

A qualitative characterization of the ecological communities was performed to determine the ecological community at SEAD-16. This assessment addresses potentially significant risks to the following biological groups and special-interest resources associated with the site: vascular vegetation, wildlife, aquatic life, endangered and threatened species, and wetlands. The focus of this assessment lies in the area of the Abandoned Deactivation Furnace and the immediately surrounding vicinity. The Abandoned Deactivation Furnace has been evaluated as a single site, with references being made to specific locations when it is appropriate. The aquatic study area included intermittent and perennial drainage ditches at the Abandoned Deactivation Furnace. The terrestrial study area included the Abandoned Deactivation Furnace and the area within a radius of approximately 2 miles from the site perimeter. Within the 2-mile radius, significant resources such as NYSDEC significant habitats; habitats supporting endangered, threatened, and rare species; species of concern; and state-regulated wetlands were identified. Within a smaller 0.5-mile radius of the site perimeter, the major vegetative communities, wildlife species associated with each cover type, and the value of the habitats to the associated wildlife were identified.

The information gathered for the ecological assessment will be used in the Ecological Risk Assessment (ERA) component of the Baseline Risk Assessment (BRA) to evaluate the likelihood that adverse ecological effects are occurring or may occur as a result of exposure to chemicals associated with the site based on a weight-of-evidence approach.

3.1.7.2 Site Habitat Characterization

Site-specific data were compiled regarding the types of habitats and wildlife species found in the site vicinity. No biological sample collection or inventory was conducted for the ecological investigation, with the exeption of minnow traps to help evaluate aquatic resources. The area considered likely to exhibit an interaction between elements of the local ecology and site-related contaminants occurs within a 2-mile radius of the site property. Due to land use patterns and geography within the 2-mile radius, evaluation of ecological resources and habitats is focused more on areas of potential exposure rather than on arbitrary distances or boundaries that lack a biological justification (EPA, 1989b). Multiple site visits were conducted during October 1996 to evaluate the habitat conditions within the radius of concern. A general evaluation of ecological resources and land use patterns within a 2-mile radius was conducted in conjunction with the site inspection. A general vegetative cover type map was prepared for areas within a 2-mile radius of the site and is presented in Figure 3-8. A more detailed vegetative cover type map of the 0.5-mile radius is presented in Figure 3-9. Observations and assessments were concentrated on undeveloped areas, waterways, and wetlands on and adjacent to the site. Vegetative classifications used in this assessment are based on NYSDEC Natural Heritage Program *Ecological Communities of New York State* (Reschke, 1990)

Information presented in this section was acquired by a combination of literature review, file searches, telephone interviews, office visits, and site inspection. Information was obtained from various departments of the NYSDEC including the headquarters in Albany, NY, the Region 8 offices in Avon, NY, the Wildlife Resources Center in Latham, NY, the NYSDEC Bureau of Monitoring and Assessment Ambient Surface Water Monitoring Program, and the Rotating Intensive Basin Survey. Information was also obtained from the Albany headquarters of the New York State Department of Health (NYSDOH), the State University of New York College of Environmental Science and Forestry (SUNY ESF), Cornell University, the US Fish and Wildlife

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FIGURE 3-8
GENERAL VEGETATIVE COVERTYPE
WITHIN 2.0 MILES OF SEAD-16

1" = 2000' | JANUARY 1997 | A

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FIGURE 3-9
DETAILED VEGETATIVE COVERTYPE
WITHIN 0.5 MILES OF SEAD-16

1" = 500'
JANUARY 1997
A

Service (USFWS), the US Geological Survey Water Resources Division, and from publications of the Society of American Foresters. Site-specific resource information was acquired from the Seneca Army Depot *Natural Resources Management Plan* (SEDA, 1992c) and *Wetlands, Fish and Wildlife Plan* (SEDA, 1995). Regional information was obtained from the USGS 7 1/2 minute Romulus and Ovid, NY topographic maps; New York State Article 24 Freshwater Wetlands maps; the US Fish and Wildlife Service National Wetlands Inventory the US Department of Agriculture (USDA) Natural Resources Conservation Service (formerly, Soil Conservation Service); and the US Commerce Department *Climatic Atlas of the United States* (US Department of Commerce, 1983).

3.1.7.2.1 Regional Climate

Weather conditions in Seneca County exhibit seasonal fluctuations in temperature, precipitation, and prevailing winds. The climate in the region consists of moderately cold winters and warm, humid summers. The region exhibits a frost-free season of 135 days and a growing season of approximately 165 to 180 days (NOAA, 1990). Lake Ontario has a regional moderating effect on both daytime highs and nighttime low temperatures. Frost-free season length increases with proximity to the lake. Monthly precipitation in Seneca County is relatively uniform with no well-defined wet or dry seasons. The lightest precipitation commonly occurs in winter and the heaviest in late spring to midsummer. In 7 years in 10, total annual precipitation ranges from 26.5 to 37.5 inches. Rainfall during the May through September growing season is ordinarily 14.5 to 15.5 inches. Summer temperatures of 90⑤F or higher occur from 8 to 15 days in most years, mostly in June, July, and August. Average seasonal snowfall is 60 to 65 inches. Most days from early December through mid-March have at least 1 inch of snow cover on the ground (USDA, 1972).

3.1.7.2.2 Terrestrial Physical Characteristics

The Seneca Army Depot is situated due west of the village of Romulus, NY and 12 miles south of the villages of Geneva and Seneca Falls, NY. The site lies within the area described in the *Atlas of Forestry in New York* as the 1,400,000-acre Eastern Lake Plains region at the edge of the Allegheny Plateau (Society of American Foresters, 1973). The Allegheny Plateau exhibits irregular and broadly rolling topography in a complex pattern of high, rounded ridges flanked by steep, irregular valleys with elevations ranging from 500 to 2,500 feet. The Seneca Army Depot occupies 10,587 acres of a high, broad plateau separating Cayuga Lake, to the east, and Seneca Lake, to the west.

Topography across the depot slopes gently from 765 feet at the southeast corner to 585 feet at the northwest corner.

The SEAD-16 site consists of an essentially flat fill area measuring roughly 350 feet by 350 feet. The site is occupied by the abandoned deactivation furnace (building 311) and associated loading docks and outdoor storage lots. The surface of the site exhibits very poor soil development and consists mostly of gravel and crushed shale, along with concrete and asphalt pavement and railroad beds. Topography surrounding the site is graded essentially flat to facilitate railroad sidings and loading docks.

Four watersheds are present on the depot (USDA, 1989). Kendaia Creek drains the central portion of the site westward into Seneca Lake. Reeder Creek drains the northwest and north-central regions of the facility. The northeast portion of the site drains into Kendig Creek, which flows north into the Cayuga-Seneca Canal. The southern part of the depot is drained by Indian Creek, which empties into Seneca Lake near Sampson State Park. The SEAD-16 site is located in the headwaters region of the Kendaia Creek watershed.

The site is filled and graded, allowing no standing water to accumulate on the ground surface. Surface water runoff is collected primarily in a pair of ditches that flow parallel to the railroad tracks southeast of the site and a swale running due south from the site, parallel with the ammunition area perimeter fence. The two primary drainages are each tributary to Kendaia Creek at a point approximately 700 to 800 feet south of the site fence, respectively. A secondary ditch, 100 feet east of the site fence, collects drainage from the meadow area on the east side of the site, and is a tributary to the ditches along the railroad tracks. Surface water was observed, through one of the open bay doors in the building's basement, to have flooded the building's interior to a depth of approximately two to three feet.

3.1.7.2.3 Land Use and Vegetative Cover

Land use at the depot is controlled by the facility mission. The entire facility has restricted access and is surrounded by chain-link fencing topped with barbed wire. The depot has a roadway network consisting of paved macadam, concrete, and gravel roads totaling approximately 141 miles. Land use is divided into three categories at the depot. The Main Post accounts for 9,832 acres and consists of an exclusion area containing partially buried, reinforced concrete igloos, general storage magazines, and warehouses. The cantonment areas of the facility consist of the North and South Posts. The North Post, at the north end of the Main Post, includes former troop housing, troop support, and community services. The South Post is located in the southeast portion of the facility near Route 96 and is a developed area containing warehouses, administration buildings, quarters, and community services.

SEAD-16 is located at the western edge of the South Post area and adjoins the Main Post (ammunition area) perimeter fence. Land use at SEAD-16 consists of an abandoned building, storage lots, and derelict structures. Access to the site is restricted by perimeter chain-link fencing.

The vegetative communities within the 0.5-mile study area are predominantly upland cover types unevenly distributed among the developed areas of the South Post. Vegetation and land use within the 0.5-mile radius study area are depicted in Figure 3-9. Cover types include mown lawns, old fields, shrublands, and deciduous forest. Unvegetated areas consist of open storage lots, railroads, paved roads, and buildings. Unvegetated corridors are maintained by herbicide application along the railroad tracks adjacent to the site.

On-site vegetation is sparse. Only a few specimens of common weeds have been able to establish root systems in the compacted fill soils at the site. No shrub or tree strata are present. Vegetation consists of grasses and early successional herbaceous species, primarily spotted knapweed (*Centaurea maculosa*), orchard grass (*Dactylis glomerata*), and various other grasses. These species occupy approximately 5 percent of the ground surface of the site. A listing of observed plant species and community associations at the site and within the 0.5-mile study area is presented in Table 3-4.

The types and distribution of vegetative communities surrounding the site result from decades of human modification of the environment of South Post and the ammunition area (Main Post) (SEDA, 1992a, c). Mowing, drainage diversion, building construction, landscaping practices, forestry practices, plantations, and herbicide application all control the composition of vegetation surrounding the site. The following sections describe the vegetation and ecological community types that were observed within the 0.5-mile study area. Classification of the communities is presented consistent with the approach presented in *Ecological Communities of New York State* (Reschke, 1990).

Table 3-4

Community Affiliations of Species Observed Within the 0.5-Mile Study Areas

SEAD-16 and SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Species Observed		Terrestrial Sub-system			Aquatic Sub-system		Palustrine Sub-system		
		Open Uplands	Forested Uplands	Terrestrial Cultural	Riverine Cultural	Natural Streams	Open Mineral Soil		Forested
Common Name	Scientific Name	Old Field	Upland Hardwood Forest	Various Types*	Ditch/ Artificial Stream	Rocky Headwaters Stream	Shallow Emergent Marsh	Shrub Swamp	Hardwood Swamp Forest
BIRDS									X
Wood duck	*Aix sponsa*								X
Great blue heron	*Ardea herodias*				X				
Great horned owl	*Bubo jamaicensis*	X	X						
Red-tailed hawk	*Buteo jamaicensis*	X	X	X					
Turkey vulture	*Cathartes aura*	X							
Northern flicker	*Colaptes auratus*		X						
American crow	*Corvus brachyrhynchos*			X					
Blue jay	*Cyanocitta cristata*		X	X					X
American kestrel	*Falco sparverius*		X	X					
Northern junco	*Junco hyemalis*		X						
Ring-billed gull	*Laurus delanarensis*			X					
Eastern wild turkey	*Meleagras gallopavo*	X	X					X	X
Pileated woodpecker	*Oryocopus pileatus*		X						X
Black-capped chickadee	*Parus atricapillus*	X	X	X				X	X
White-breasted nuthatch	*Sitta carolinensis*	X	X	X				X	X
European Starling	*Sturnus vulgaris*	X		X					
American robin	*Turdus mignatorius*		X	X					
Mourning dove	*Zenaida macroura*	X		X					
MAMMALS									
Eastern coyote	*Canis latrans*		X				X		X
Beaver	*Castor canadensis*				X				X
Mouse	Cricetidae	X	X	X				X	X
Woodchuck	*Marmota monax*								
Striped skunk	*Mephitis mephitis*		X	X					
White-tailed deer	*Odocoileus virginianis*	X	X	X			X	X	X
Raccoon	*Procyon lotor*			X	X	X			X
Eastern grey squirrel	*Sciurus carolinensis*								
Eastern cottontailed rabbit	*Sylvilagus floridanus*	X	X						

Table 3-4

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SEAD-16 and SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Species Observed		Terrestrial Sub-system			Aquatic Sub-system		Palustrine Sub-system		
		Open Uplands	Forested Uplands	Terrestrial Cultural	Riverine Cultural	Natural Streams	Open Mineral Soil		Forested
Common Name	Scientific Name	Old Field	Upland Hardwood Forest	Various Types*	Ditch/ Artificial Stream	Rocky Headwaters Stream	Shallow Emergent Marsh	Shrub Swamp	Hardwood Swamp Forest
FISH									
Creek chub	*Semotilus atromaculatus*				X	X			
Bluegill	*Lepomis machrochirus*				X	X			
CANOPY TREES									
Red maple	*Acer rubrum*		X						X
Sugar maple	*Acer saccarum*		X						
Shagbark hickory	*Carya ovata*		X						
Hawthorn	*Crataegus s p.*		X						
Beech	*Fagus grandifolia*		X						
White ash	*Fraxinus americana*								
Green ash	*Fraxinus pennsylvanica*								X
Butternut	*Juglans cinerea*		X	X					
Black walnut	*Juglans nigra*		X						
Tamarack	*Larix laricina*		X						
White spruce	*Picea glauca*		X						
Sycamore	*Platanus occidentalis*								X
Eastern cottonwood	*Populus deltoides*		X	X					X
White oak	*Quercus alba*		X						
Pin oak	*Quercus palustris*		X						X
Chestnut oak	*Quercus prinus*		X						
Northern red oak	*Quercus rubra*		X						
Common buckthorn	*Rhamnus cathartica*		X						X
Staghorn sumac	*Rhus typhina*	X	X						
Black locust	*Robinia pseudoacacia*		X						X
American elm	*Ulmus americana*		X						

Table 3-4

Community Affiliations of Species Observed Within the 0.5-Mile Study Areas

SEAD-16 and SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Species Observed		Terrestrial Sub-system			Aquatic Sub-system		Palustrine Sub-system		
		Open Uplands	Forested Uplands	Terrestrial Cultural	Riverine Cultural	Natural Streams	Open Mineral Soil		Forested
Common Name	Scientific Name	Old Field	Upland Hardwood Forest	Various Types*	Ditch/ Artificial Stream	Rocky Headwaters Stream	Shallow Emergent Marsh	Shrub Swamp	Hardwood Swamp Forest
UNDERSTORY TREES									
Box elder	*Acer negundo*								X
American hornbeam	*Carpinus caroliniana*								X
Hawthorn	*Crataegus crus-galli*								X
Juniper (cedar)	*Juniperus virginiana*								X
Mulberry	*Morus alba*								
Eastern hop hornbeam	*Ostrya virginiana*								
Cherry	*Prunus avium*								
Black cherry	*Prunus serotina*								
Choke cherry	*Prunus virginiana*								
Staghorn sumac	*Rhus typhina*								
Black locust	*Robinia pseudoacacia*								
Willow	*Salix cinerea*								X
Willow	*Salix interior*								X
SHRUB LAYER									
Alder	*Alnus incana* ssp. *rugosa*	X						X	
Stiff dogwood	*Cornus foemina*	X						X	
Red-osier dogwood	*Cornus stolonifera*	X						X	
Spicebush	*Lindera benzoin*	X							
Swamp fly honeysuckle	*Lonicera oblongifolia*						X	X	X
Honeysuckle	*Lonicera* spp.	X	X	X					
Honeysuckle	*Lonicera tatarica*								
Rose	*Rosa multiflora*	X	X	X					
Red raspberry	*Rubus idacus*	X							
Poison ivy	*Toxicodendron radicans*		X						
Arrow wood	*Viburnum recognitum*		X						

Table 3-4

Community Affiliations of Species Observed Within the 0.5-Mile Study Areas

SEAD-16 and SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Species Observed		Terrestrial Sub-system			Aquatic Sub-system		Palustrine Sub-system		
		Open Uplands	Forested Uplands	Terrestrial Cultural	Riverine Cultural	Natural Streams	Open Mineral Soil		Forested
Common Name	Scientific Name	Old Field	Upland Hardwood Forest	Various Types*	Ditch/ Artificial Stream	Rocky Headwaters Stream	Shallow Emergent Marsh	Shrub Swamp	Hardwood Swamp Forest
HERBACEOUS									
Yarrow	*Achillea millefolium*	X							
Common ragweed	*Ambrosia artemisiifolia*	X							
Burdock	*Arctium* sp.	X							
Jack-in-the pulpit	*Arisaema dracontium*		X						X
Milkweed	*Asclepias syriaca*	X							
Chess	*Bromus mollis*	X		X					
Sedge	*Carex intumescens*						X		
Fox-tail sedge	*Carex vulpinoidea*						X		
Spotted knapweed	*Centaurea maculosa*	X		X					
White daisy	*Chrysanthemum leucanthemum*	X							
Chickory	*Cichorium intybus*	X		X					
Queen Anne's lace	*Daucus carota*	X		X					
Hairgrass	*Deschampsia flexuosa*	X		X					
Teasel	*Dipsacus fullonum*	X		X					
Wood fern	*Dryopteris* sp.		X						X
Spikerush	*Eleocharis palustris*						X	X	
Elodea	*Elodea sp.*					X	X		
Horsetail	*Equisetum fluviatile*				X		X	X	X
Trout lily	*Erythronium americanum*		X						
Boneset	*Eupatorium perfoliatum*	X							
Wild strawberry	*Fragaria virginiana*	X							
Bedstraw	*Galium aparine*	X							
Manna grass	*Glyceria borealis*	X							
Hawkweed	*Hieracium* sp.	X							
St.-John's-wort	*Hypericum perforatum*	X							
Spotted touch-me-not	*Impatiens capensis*		X						X
Iris	*Iris versicolor*							X	X
Rush	*Juncus canadensis*						X	X	
Rush	*Juncus effusus*						X	X	

Table 3-4

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Seneca Army Depot Activity

Species Observed		Terrestrial Sub-system			Aquatic Sub-system		Palustrine Sub-system		
		Open Uplands	Forested Uplands	Terrestrial Cultural	Riverine Cultural	Natural Streams	Open Mineral Soil		Forested
Common Name	Scientific Name	Old Field	Upland Hardwood Forest	Various Types*	Ditch/ Artificial Stream	Rocky Headwaters Stream	Shallow Emergent Marsh	Shrub Swamp	Hardwood Swamp Forest
Rye-grass	*Lolium perenne*								
Bird's-foot trefoil	*Lotus corniculatus*	X							
Purple loosestrife	*Lythrum salicaria*	X					X	X	
White sweet clover	*Melilotus alba*	X							
Sensitive fern	*Onoclea sensibilis*		X						X
Cinnamon fern	*Osmunda cinnamomea*		X						X
Royal fern	*Osmunda regalis*		X						X
Panic grass	*Panicum* spp.	X							
Timothy	*Phleum pratense*	X							
Common reedgrass	*Phragmites australis*						X		
Poke weed	*Phytolacca americana*	X		X					
English plantain	*Plantago lanceolata*	X		X					
Common plantain	*Plantago major*			X					
Plantain	*Plantago media*			X					
Bluegrass	*Poa palustris*			X					
Kentucky bluegrass	*Poa pratensis*			X					
May-apple	*Podophyllum peltatum*		X						X
Solomon's seal	*Polygonatum biflorum*		X						X
Rough-fruited-cinquefoil	*Potentilla recta*	X		X					
Curly dock	*Rumex crispus*			X					
Bulrush	*Scirpus atrovirens*						X	X	
Canada goldenrod	*Solidago canadensis*	X		X					
Skunk cabbage	*Symplocarpus* sp.							X	X
Dandelion	*Taraxacum officinale*	X		X					
Painted trilium	*Trillium undulatum*		X						X
Narrowleaf cattail	*Typha angustifolia*						X	X	
Cattail	*Typha latifolia*						X	X	
Cow vetch	*Vicia craca*	X		X					
Vetch	*Vicia tetrasperma*	X		X					

Upland Forest Communities

Appalachian Oak-Hickory Forest. This cover type represents a relatively minor component within the 0.5-mile study area in small, undisturbed remnant forests, bisected by ammunition area roads. These forests usually exhibit nearly complete canopy cover; abundant mast-bearing trees; and a shaded, sparse understory. The oak-hickory forests within the subject area are composed of northern red oak (*Quercus rubra*), white oak (*Quercus alba*), shagbark hickory (*Carya ovata*), and black walnut (*Juglans nigra*). The shrub stratum is dominated by saplings of these species as well as red maple (*Acer rubrum*), hawthorn (*Crataegus* sp.), butternut (*Juglans cinerea*), and vines of wild grape (*Vitis* sp.), poison ivy (*Toxicodendron radicans*), and raspberry (*Rubus idacus*).

Successional Northern Hardwoods. Successional northern hardwoods are present in areas where sufficient time has elapsed since disturbance to facilitate the development of a dense overstory canopy (75 percent cover). Particularly even-aged stands of red maple within this forest type are possibly deliberate plantations. Dominant overstory trees are red maple, eastern cottonwood (*Populus deltoides*), and northern red oak.

Conifer Plantation. The single occurrence of this vegetation type consists of a tamarack (*Larix laricina*) monoculture plantation located between the ammunition area roads B9 and C1, near the western fringe of the 0.5-mile radius. Small diameter tamaracks closely spaced at intervals occupy a plot in the area between the roadways. Close spacing and invasion of the understory by oldfield species appears to be limiting the prospects for this stand to mature into a significant covertype. While some scattered tamarack are present in surrounding cover types, they are apparently not vigorous enough to compete with fast-growing oldfield species and are exhibiting sparse new growth.

Deciduous tree plantation. Plantations of butternut and red maple appear to have been planted in the past, probably to create vegetative diversity and forage. Butternut stands, because of phytotoxins in the husks of their fruit, deter plant growth and exhibit a suppressed understory. Much of the shrub layer under the butternuts consists of only one species, raspberry, which appears to tolerate the altered soil chemistry.

Terrestrial Cultural Communities

Paved Roads and Mowed Roadside. Each of the ammunition area roadways has a paved width of 12 feet and has a mown and cleared margin of approximately 30 feet in width. Vegetative growth along site roads is maintained by mowing to provide suitable visibility and access, and to serve as fire breaks. No overstory or shrub layer is present within 30 feet of each edge of the asphalt pavement. Herbaceous growth is limited to grasses, sedges, and forbs able to withstand several mowings through the growing season.

Abandoned Structure Interior/Exterior. The abandoned building at SEAD-16 provides nesting habitat for barn swallows, roosting sites for bats, and shelter for small mammals. No other habitat utilization of the abandoned building was observed. The basement of the building was flooded to a depth of 1 to 2 feet at the time of the inspection and it is suspected that the conditions observed prevail throughout much of the year. Amphibians may be utilizing the flooded portions of the basement but full inspection of the flooded interior was not conducted.

Ore Piles. Large ore piles consisting of ferro-manganese boulders/cobbles are present along the railroad sidings nearly 0.5 mile from the site. These ore piles offer no substrate for vegetation and are generally barren. Interstices near the ground surface may be exploited as shelter by small mammals. No significant habitat opportunities are otherwise offered in and around the ore stockpiles.

Railroads. Railroad tracks in the vicinity of the site were observed as being hunting grounds of red-tailed hawk and great horned owl during the field visits. Prominent perches adjacent to railroad corridors were occupied by these birds frequently during the site visits. Railroads apparently serve as trails for nocturnal creatures, as tracks and scat of skunk, raccoon, fox, and opossum were observed frequently. Poor rooting substrate and herbicide application suppress vegetation along the tracks and shoulders.

Palustrine Communities

The revised NYSDEC 1985 Article 24 Freshwater Wetlands map (Ovid, NY quadrangle) and USFWS National Wetlands Inventory (USFWS, 1991) map identify 32 freshwater wetlands within a 1-mile radius of the site. These wetlands are shown in Figure 3-10.

LEGEND

1.0 MILE BOUNDARY

ROADS

WATERWAY

PUBHh FEDERAL WETLANDS WITH CLASSIFICATION TYPE AS SPECIFIED IN SOURCE 2.

OV-11 STATE WETLANDS

SOURCES:

1. NYSDEC 1985 ARTICLE 24 FRESHWATER WETLANDS MAP (OVID, NY QUADRANGLE)
2. U.S. FISH AND WILDLIFE SERVICES NATIONAL WETLANDS INVENTORY MAP OVID, NY QUADRANGLE (1991)

500 0 500 1000

1" = 1000'

PARSONS

PARSONS ENGINEERING SCIENCE, INC.

SENECA ARMY DEPOT ACTIVITY

RI/FS

SEAD-16 ABANDONED DEACTIVATION FURNACE

ENVIRONMENTAL ENGINEERING

FIGURE 3-10

WETLANDS WITHIN 1.0 MILE RADIUS OF SEAD-16

1" = 1000'

JANUARY 1997

A

The nearest wetland (OV-8) identified on the 1985 NYS Article 24 Freshwater Wetlands map is located approximately 2,000 feet downgradient, west of the site. Another NYS designated wetland (OV-5) occurs within the 0.5-mile radius study area, but is located outside the perimeter fence and occurs in an apparently upgradient position located on the opposite side of Route 96 from the SEAD property. A portion of NYS designated wetland OV-7 occurs within 1 mile of the site.
The USFWS NWI map depicts four wetland environments within 0.5 mile of the site and an additional 25 wetlands within a 1-mile radius. Wetlands systems within the 1-mile radius consist of palustrine forested, scrub-shrub, and emergent vegetative types and open water wetlands exhibiting several vegetative subclasses and hydrologic regimes.

Shallow emergent marshes, forested wetlands, and shrub swamps are depicted on Figure 3-10. Palustrine emergent marshes within 0.5 mile of the site are limited to the fringes of streams and ditches and result from diversion of naturally occurring drainage patterns. Forested wetlands result from disruption of local drainages and flooding caused by beaver dams.

Riverine Communities

The headwaters of Kendaia Creek are present in the site vicinity, approximately 800 feet to the south of SEAD-16. The creek is a first-order stream with a modified dendritic drainage pattern that drains to the west, across the ammunition area, then into Seneca Lake at Pontius Point. The upper reaches of Kendaia Creek have been modified (channeled and straightened) to facilitate better surface water runoff from the South Post. Unnamed tributaries from the SEAD-16 site contribute to the upper reaches of Kendaia Creek at the point where the creek enters the Ammunition Area (Main Post) from the South Post.

The watershed land use at the headwaters of the creek (South Post) is low-density industrial complex with maintained grades, stable soils, and adequate storm sewers, with little erosion potential. Further downstream, development is limited to ammunition storage bunkers in the ammunition area (Main Post). Approximately 500 feet downstream of the ammunition area/South Post fence, the creek is impounded by a series of three beaver dams.

Ditch/Artificial Stream. Kendaia Creek exhibits markedly different physical characteristics in modified and undisturbed sections. The upper, channelized sections are lined with steep unconsolidated banks of crushed shale fill. Canopy cover in the channelized portion is absent. Estimated stream width varies from 10 to 20 feet with depths ranging from 2 to 4 feet. Less than 10 percent of the substrate consists of rubble, gravel, or other stable habitat. Due to a series of three beaver dams downstream, the upper reaches of the creek are impounded into a pool condition dominated by a uniform velocity/depth category. Emergent vegetation occupies the inundated sections and a sparse shrub cover is present along the banks. The shale-fill banks end abruptly approximately 500 feet downstream of the South Post fence. This is the location of the first of a series of active beaver dams impounding water in this section of creek and the point where stream morphology changes greatly. The dams flood the forest along both banks of the creek .

Rocky Headwater Stream. The sections downstream of the first series of beaver dams differ in flow, depth, substrate, and canopy. Water velocity is greater, producing a scouring effect exposing shale bedrock, cobbles, pebbles, and coarse sands. Pools are small and shallow and most of the run is dominated by riffles. The canopy over the unmodified sections of the creek is dense and the banks are firmly anchored by a dense growth of shrubs. Organic matter consists chiefly of coarse leaf litter.

3.1.7.2.4 Aquatic Resources

Minnow traps deployed in the modified ditch, constituting the headwaters of Kendaia Creek, captured specimens of creek chub (*Semotilus atromaculatus*) and bluegill sunfish (*Lepomis macrochirus*). Captured creek chubs (17 specimens) ranged from 1.3 to 6 inches total maximum length. Ten bluegill sunfish captured ranged from 1 to 3 inches total length. These species were also observed in the downstream reaches. Creek chub also were observed in an unnamed tributary ditch of Kendaia Creek that runs parallel to the railroad siding leading to the gate at SEAD-16. Chubs were observed as far upstream in this ditch as the gate leading into the site. Tracks of piscivorous wading birds, probably great blue heron (*Ardea herodias*) and green-backed heron (*Butorides striatus*), were observed on the creek banks. Wood ducks (*Aix sponsa*) were observed in the pool area near the beaver dams. Green frog (*Rana clamitans melanota*) and northern leopard frog (*Rana pipiens*) were observed in various locations. Small fish were abundant in the upper reaches of the creek.

3.1.7.2.5 Stressed or Altered Vegetation

No adverse ecological effects were identified at the site that could be directly attributed to chemical contaminants. Direct evidence of contaminant stress on individual plants was not observed in the study area. No evidence of stunted, dead, or chlorotic vegetation was observed in the subject area. Examination of nearby surface waters yielded no indication of unusual colors, odors, precipitates, staining, or sheens. Natural gradients of plant succession and community composition would not be expected to be visible under the highly disturbed conditions prevalent at the site. It is therefore not possible to evaluate contaminant impacts in terms of vegetation type, abundance, or distribution. Bare areas scattered elsewhere on the site appeared directly attributable to very poor soil development in the surficial fill and are not considered a result of contaminant effects. No seeps or outbreaks of contaminated site drainage were noted along the perimeter of the site.

3.1.7.2.6 Wildlife Resources

Wildlife resources at the Seneca Army Depot activity are intensively managed under a cooperative conservation and development plan developed in conjunction with the NYSDEC (1992). The objectives of the fish and wildlife management plan are to:

a. protect and develop habitat for the production of game and non-game species;
b. control white-tailed deer (*Odocoileus virginianus*) harvest (with additional emphasis on white-tailed deer management);
c. enhance non-game species populations for their aesthetic, recreational, and educational values; and
d. establish long range goals for selected species including eastern bluebird (*Salia salis*), ring-necked pheasant (*Phasianus colchicus*), wood duck, white-tailed deer, and wild turkey (*Meleagris gallopavo*).

Commonly occurring small game mammals within the Main Post include eastern cottontail rabbit (*Sylvilagus floridanus*), gray squirrel (*Sciurus carolinensis*), raccoon (*Procyon lotor*), snowshoe hare (*Lepus americanus*), muskrat (*Ondatra zibithecus*), beaver (*Castor canadensis*), eastern coyote (*Canis latrans*), red fox (*Vulpes vulpes*), and gray fox (*Urocyon cinereoargenteus*). Ruffed grouse (*Bonasa umbellus*), ring-necked pheasant, and wild turkey also inhabit the depot. Waterfowl are attracted to wetlands on and around the depot, particularly the 87-acre "duck ponds" created in the northeast corner of the property during the 1970s.

The wildlife within 0.5 mile of the site consists of upland species, particularly those favoring old fields and shrublands and freshwater wetlands since these are abundant habitats in the study area. The mixture of these habitats with small woodlots and tree rows provides ideal habitat for white-tailed deer, which are common throughout the depot. Many non-game species also are present in the depot and potentially utilize habitats within the 0.5-mile study area.

Tracks, presumed to be of eastern coyote, coy-dog, or feral dog, were observed along the railroad sidings, west of the site. (While their tracks are often indistinguishable, no domestic dogs remain on the South Post since base closure.) Tracks of white-tailed deer, raccoon, and rabbit also were observed adjacent to the site. Wildlife evidence and direct observations made during site visits are presented in Table 3-4.

3.1.7.2.7 Endangered Species and Significant Habitats

The NYSDEC Natural Heritage Program Biological and Conservation Data System identifies no known occurrences of federal- or state-designated threatened or endangered plant or animal species within a 2-mile radius of the site. No species of special concern are documented within the depot property. Field investigation of the site determined that the surrounding area is highly modified and has a disturbed ecology resulting from management consistent with mission activities. Highly disturbed sites are characteristically colonized by pioneer species and agricultural "weeds" and do not typically support rare or endangered species. No rare or endangered plant species were observed during the site reconnaissance.

3.1.7.2.8 Habitat Assessment

Resource Values to Wildlife

The 9,832-acre Main Post is the focus of wildlife and forestry management practices being conducted at the depot. Wildlife management efforts focusing on waterfowl, songbirds, and game populations have been conducted for many years.

Overall, the small and highly-dissected meadow, forest, and oldfield habitats in the study area provide marginal habitat value. Extensive development and human traffic within the South Post likely deter wildlife utilization. Proximity to extensive mixed cover types of the Main Post probably enhances these habitats as foraging areas somewhat, and contributes diversity to the local environment.

The South Post is largely developed land that experiences indirect effects of the Main Post wildlife management strategies. For example, while the Main Post and South Post are separated by a chain-link fence, breaches in the fence were observed to provide access to nocturnal grazing areas on South Post. White-tailed deer move to the South Post to graze lawns and gardens at night and return to the relative safety of the Main Post during the daylight hours. Many small mammals probably find the fencing no great barrier and may forage in a similar manner. Wildfowl and songbirds also may seek the Main Post solitude during the mid-day and seek foraging opportunities in the South Post during the early morning and evening. Landscaped lawns with exotic plantings, bird feeders, and garbage dumpsters offer foraging opportunities not available in the undeveloped Main Post. Wildlife management practices on the Main Post, therefore, have a spillover effect into the 0.5-mile study area of this ERA.

Wildlife and aquatic life that were observed within the 0.5-mile radius are presented in Table 3.4. In general, common wildlife species exploiting oldfield, successional forest, mature hardwood forest, and wetlands potentially occur within 0.5 mile of the site. Kendaia Creek and unnamed tributaries occur within the radius of concern and support a permanent aquatic community.

The habitat value of the SEAD-16 site itself is considered marginal. The surrounding perimeter fence excludes large mammals such as white-tailed deer, fox, and coyote. The gate over the access road reaches to within 6 inches of the ground surface and offers access by small mammals such as rabbits, raccoons, and woodchucks (*Marmota monax*). No burrows were observed on the site. Mice, voles, and shrews would not be excluded by the perimeter fence. No mature trees are available for bird nesting or for dens. Ground-nesting birds preferring exposed gravel substrates, such as killdeer (*Charadrius vociferus*) may find suitable nesting conditions on the site, whereas tall grasses are too sparse to offer nesting habitat for ground nesters requiring concealment. Abundant evidence (scat) of small mammals was observed in and around the abandoned deactivation furnace building (S-311) and in the pallet yard outside the fence. Human activity on and around the site probably discourages habitat utilization by some species.

Resource Value to Humans

The Seneca Army Depot Activity represents a unique opportunity for wildlife and pest control research in New York state due to its large size and continuous perimeter fencing. The depot property represents significant value to humans resulting from decades of wildlife management and scientific research. The NYSDEC has used the depot white-tailed deer population to develop population, growth, and reproduction models. Currently a 3-year Cornell University/NYSDEC white-tailed deer immuno-contraception study is being conducted with a captive herd in the Q area of the Main Post. NYSDEC biologists participate in annual harvests by inspecting field-dressed deer for disease and parasites, aging specimens, and measuring beam diameter (SEDA, 1992c). NYSDEC conducted studies in the 1960s on fox reproduction inhibition using diethyl stilbestrol (DES) to control the spread of rabies. Cornell University entomologists have conducted studies on the ability of northern corn rootworm to traverse areas of non-croplands at the depot (SEDA, 1992c).

Consumptive use of wildlife consists of hunting of upland birds, predators, waterfowl, and white-tailed deer. Harvest of deer is closely monitored to maintain the population below carrying capacity of the depot habitat (SEDA, 1995). Hunting on the property is presently limited to current and retired military personnel and limited numbers of guests. Hunting is conducted during both the Southern Zone archery and firearms hunting seasons in accordance with New York state regulations. Discontinuation of the military mission of the depot may have significant impacts on the types and intensity of human utilization of wildlife resources in the future.

The consumptive wildlife resource value of the SEAD-16 property to humans is considered non-existent, due to the depot being posted and patrolled against unauthorized entry. Additionally, land use in the immediate vicinity of SEAD-16 is inconsistent with consumptive wildlife uses by the general public. Future use scenarios for the South Post property (excluding complete abandonment) are not likely to increase the suitability of habitat or wildlife resource value in the vicinity of SEAD-16.

Currently much of the South Post is vacant and access to the depot is still restricted, thus limiting participation in non-consumptive wildlife uses. Evidence of non-consumptive wildlife resource utilization, such as bird watching, wildlife observation, photography, and amateur study, was not observed during the site inspection but is presumed to occur in the study area. The white-tailed deer population is an unusual herd that has an important aesthetic value. Due to breaches in the Main Post fence, white-tailed deer can be commonly observed in the South Post.

The drainages adjacent to the site do not provide exploitable fisheries resources. No recreational fishing resources are utilized within the 0.5-mile study area.

3.2 SEAD-17

3.2.1 Site Features

The Existing Deactivation Furnace Building (Building 367) is located in the Ammunition Storage in the east-central portion of SEDA approximately 800 feet southwest of SEAD-16. It is located approximately 500 feet west of the chain-link fence that defines the outer limits of the Ammunition Storage Area. SEAD-17 is characterized by an elongated deactivation furnace building that is surrounded by a crushed shale road (Figure 1-4). Beyond the permeter of the crushed shale road is grassland. Two small sheds are located in the eastern portion of the site. There is vehicular access to the site within SEDA from an unpaved road to the north. Both vehicular and pedestrian access to the site is restricted because the site is located in the ammunition storage area.

The deactivation furnace is a steel rotary kiln incinerator and is enclosed by an eight-foot-high uncovered reinforced concrete wall. The concrete wall is designed to contain the effects of a detonation. The deactivation furnace building contains an emission stack and air pollution control devices including an afterburner, two gas coolers, a cyclone and a baghouse on the southwestern side. The building appears to be in good condition and it is structurally sound.

Number 2 fuel oil was used to fire the burners in both the kiln and the afterburner, and propane is used as a pilot fuel for the afterburner. The liquid propane storage tank and the # 2 fuel oil tank are located approximately 100 feet to the southeast of the deactivation furnace building (Figure 1-4). The propane and fuel oil piping from the storage and pumping area to the incinerator area is installed in a concrete ditch for leak containment. The propane storage tank is a 1,000-gallon horizontal drum mounted on a concrete pad. The appropriate valves, fittings, regulators and piping are installed for pressure reduction and transportation of propane to the afterburner pilot train.

The fuel oil storage tank is a 4,000-gallon above-ground drum mounted on a 24- by 14-foot concrete pad. The fuel oil storage tank pad has a 30-inch-high wall on all sides for secondary containment. A pump with valves and piping is used to transport the fuel oil to the incinerator area.

Utilities on the site include overhead utilities for electricity. This line connects to the site via utility poles that originate from an area to the east.

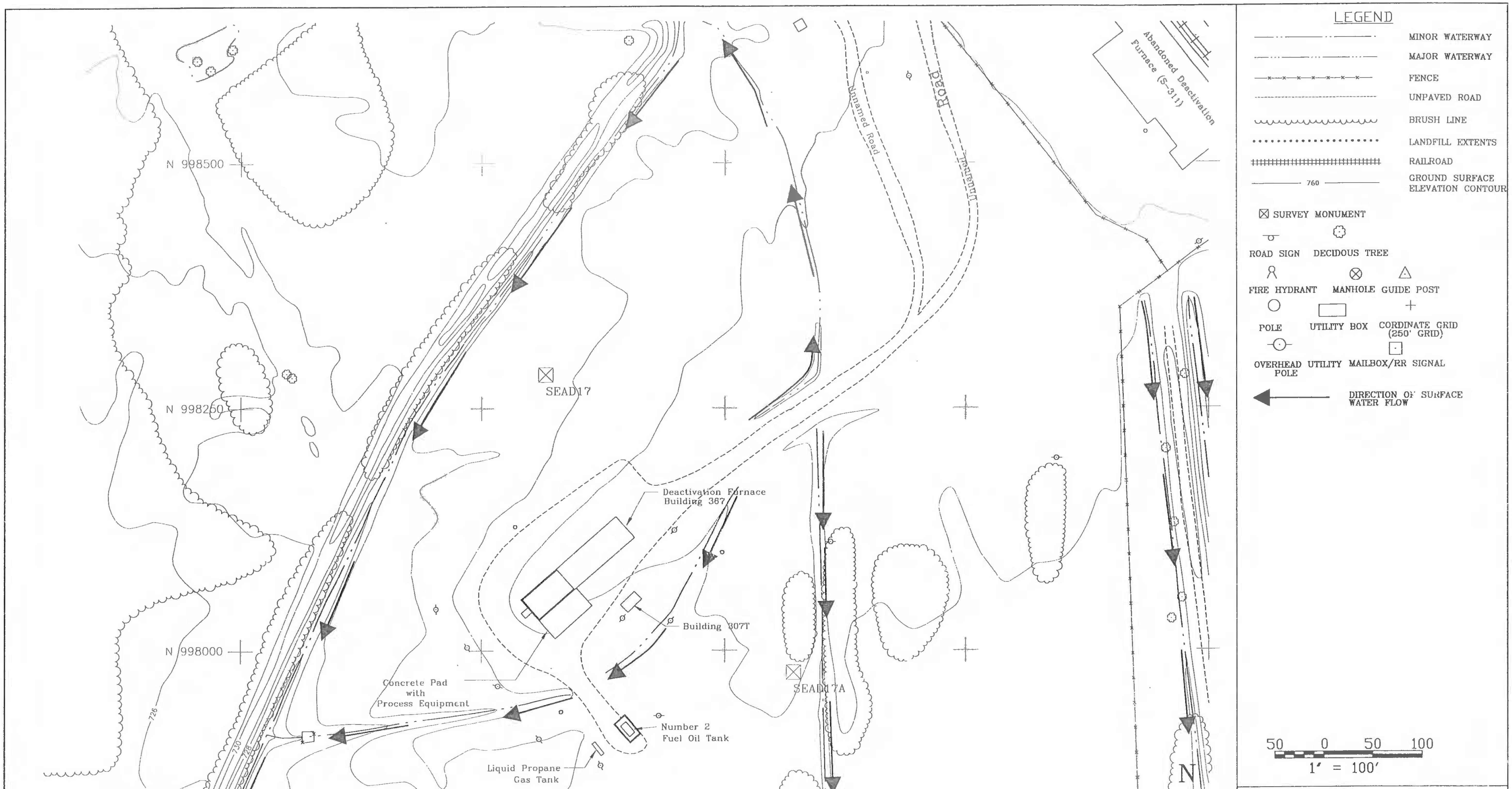
3.2.2 Topography

The site is generally flat around the furnace building, but the surrounding land slopes gently to the west and southwest as defined by the 2-foot contours (Figure 1-4). A small drainage ditch originates approximately 100 feet east of the furnace building and transports surface water to the west past the southern end of the building. This ditch intersects another, well-defined ditch that flows south and ultimately discharges into Kendaia Creek. In the eastern portion of the site, a small ditch originates on the southern side of the unpaved access road and drains due south between scattered areas of brush vegetation. On the opposite side of the unpaved road another ditch drains to the north, eventually intersecting the larger well-defined drainage ditch west of the site.

3.2.3 Surface Water

Surface water flow from precipitation events is controlled by local topography (Figure 3-11). Most of the surface water in the immediate vicinity of the furnace building flows off of the crushed shale roadway surrounding it onto lower grassland. A drainage swale traverses the eastern and southern portions of the site and transports surface water to the west. This swale intersects a well-defined south-draining swale that is defined by a elongate stand of low brush and trees; this eventually empties into Kendaia Creek. In the extreme northern portion of the site, surface water flows in a small swale drains to the north and west. The regional overland surface water flow is believed to be controlled by the overall westward sloping ground surface. There are no sustained surface water bodies on-site and flow in the drainage ditches is believed to be ephemeral.

Precipitation data from the Aurora Research Farm monitoring station were reviewed to gain a perspective on the seasonal variations in rainfall that would directly impact surface water flow. These data indicate that, historically, June has the greatest amount of rainfall at 3.9 inches, and the winter months of January and February generally have had the least amount of rainfall (Figure 1-14).



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SENECA ARMY DEPOT ACTIVITY
RI/FS
SEAD-17 ACTIVE DEACTIVATION FURNACE

DEPT	Dwg No
ENVIRONMENTAL ENGINEERING	729895-01001

FIGURE 3-11
SEAD-17 SURFACE WATER RUNOFF DIRECTIONS

SCALE	DATE	REV
1" = 100'	DECEMBER 1996	A

ACAD\SENECA\16-17RIF\SD17RO.DWG

3.2.4 Site Geology

3.2.4.1 Introduction

Similarly to SEAD-16, the site geology at SEAD-17 is characterized by gray Devonian shale with a thin weathered zone where it contacts the overlying mantle of Pleistocene till. This stratigraphy is consistent over the entire site. Artificial fill consisting of crushed shale occurs above the till at locations surrounding the deactivation furnace building and near the above ground fuel oil and propane tanks. Soil boring logs are presented in Appendix B.

3.2.4.2 Till

As at SEAD-16, the predominant surficial geologic unit present at SEAD-17 is dense till. It ranges in thickness from 2.3 feet at MW17-4 to 6.0 feet at MW17-1 and had a average of 3.7 feet. Till was present in all boring locations. It is light brown and composed of silt and clay, some fine sand and some black shale fragments. The general Unified Soil Classification System description of the till on-site is as follows: Clay-silt, brown to olive-gray, slightly plastic, small percentage of fine to medium sand, small percentage of fine to coarse gravel-sized gray shale clasts, dense and mostly dry in place, till, (ML).

According to Hutton (1972), Darian silt-loam soils, 0 to 18 inches thick, are developed in till derived mainly from local alkaline and calcareous, dark-gray and black silty shale and a small quantity of limestone. These surficial soils are somewhat poorly drained and have a silt clay loam and clay subsoil. These are nearly level to gently sloping soils on uplands in the central part of Seneca County. In general, 0-3 percent slopes are associated with these soils (Hutton, 1972). Grain size analyses were performed on surface soils that were sampled as part of the surface soil sampling program. These results are presented in Appendix D.

No grain size analyses were performed on till samples from SEAD-17. However, the grain size distributions for the till are expected to be similar to those found at SEAD-16, 800 feet to the north (Section 3.1.4.2). Grain size analysis curves for till samples collected during the installation of monitoring wells on another portion of SEDA show a wide distribution of sediment sizes (Metcalf & Eddy, 1989). Based on all of the available grain size analyses at SEDA, the till generally has a high percentage of silt and clay with lesser amounts of sand and fine gravel-sized particles (47 to 93 percent of the sample passed the No. 200 sieve). The porosities of five gray-brown silty clay (i.e., till) samples ranged from 34.0 percent to 44.2 percent with an average of 37.3 percent (USAEHA, 1985).

The minimum, maximum and average background concentrations of selected inorganic constituents in the till located on SEDA have been extensively characterized. These data are discussed in Section 1.0 and are presented in Table 1-2.

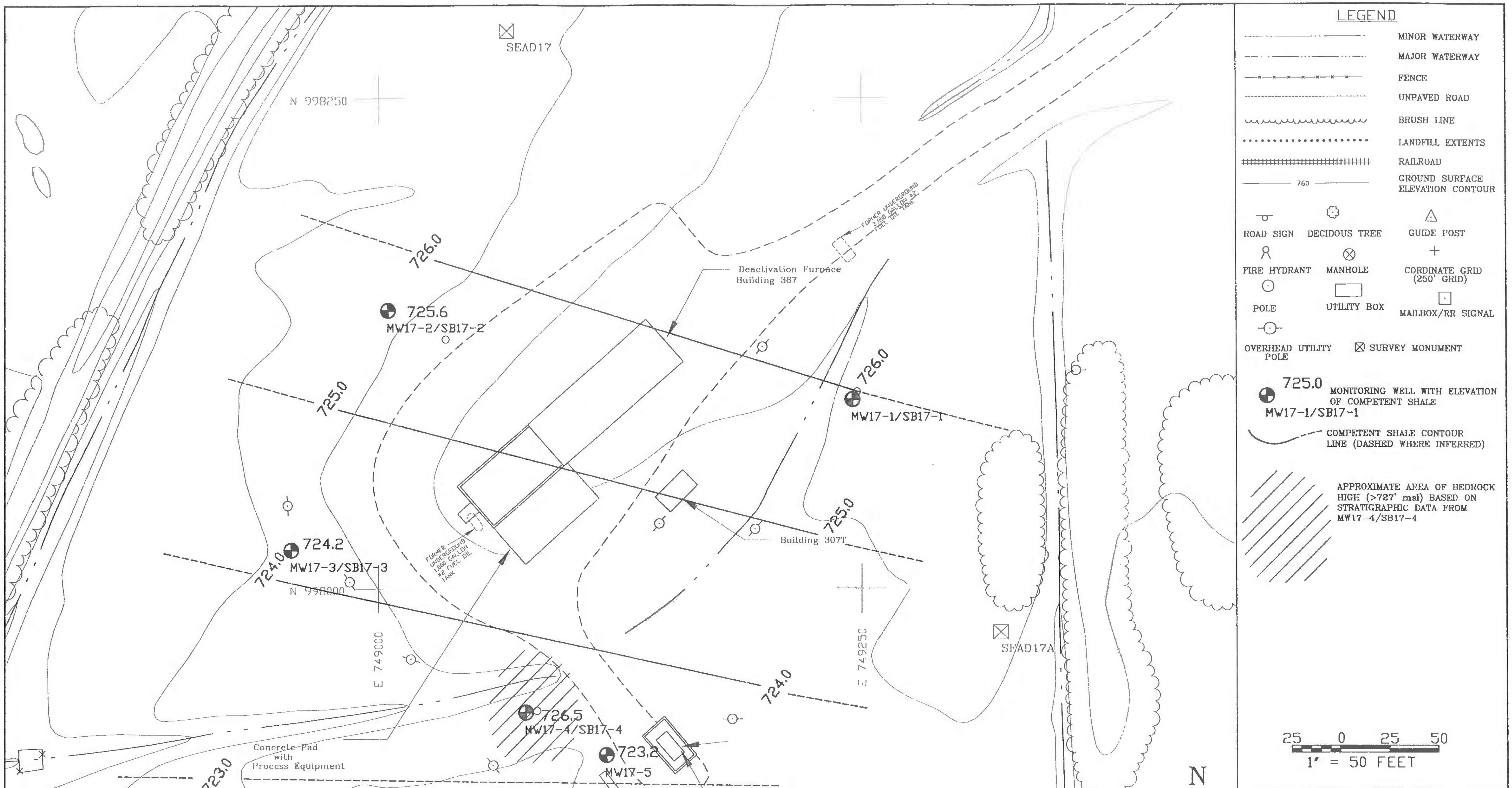
3.2.4.3 Weathered Shale

A zone of gray weathered shale of variable thickness was encountered below the till at all of the locations drilled on-site. This zone is characterized by fissile shale with a large amount of brown interstitial silt and clay. The upper boundary of the weathered shale was recorded in split-spoon samples and the base of the weathered shale was defined as the depth of refusal with the hollow stem augers or where augering became abruptly difficult and slow. The thickness of the weathered shale is between 0.5 feet and 3.3 feet thick on site. The average thickness is 2.0 feet. Differential weathering through geologic time is likely responsible for the variable thickness. No outcrops of weathered or competent shale are exposed at SEAD-17.

3.2.4.4 Competent Shale

No bedrock coring was performed at SEAD-17, and information on the characteristics of the shale is presented in Section 3.1.4.4.

Gray competent shale was encountered between 4.0 and 8.5 feet below the land surface in the borings performed on the site. A bedrock topographic map was developed based upon hollow stem auger refusal depths from these soil borings and upon visual observations made by the drilling supervisors. In all instances, auger refusal was considered to be the top of the competent shale. The bedrock topographic map is presented in Figure 3-12. Based on these data, the surface of the shale is generlly sloped to the southwest with a slightly steeper grade on the east side of the site. In addition, there is a local bedrock high (>727 feet) in the vicinity of MW17-4. The bedrock topography is at a maximum elevation of 725.0 at MW17-1 and it reaches it lowest elevation of 732.2 at two downgradient wells, MW17-3 and MW17-5. The bedrock beneath SEAD-17 corresponds with the regional slope of the surface of the competent shale which was determined based on data from other sites at SEDA.



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RI/FS
SEAD-17 ACTIVE DEACTIVATION FURNACE

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ENVIRONMENTAL ENGINEERING	729895-21001

FIGURE 3-12
SEAD-17 COMPETENT SHALE
TOPOGRAPHY MAP

SCALE	DATE	REV
1" = 50'	DECEMBER 1996	A

3.2.4.5 Filled Areas

The only filled areas noted on-site were in the immediate vicinity of the furnace building and near the aboveground fuel oil and propane tanks (MW17-5). Also, a thin mantle of fill (between 0.4 feet and 2 feet) was present in the vicinity of MW17-1 and MW17-2.

3.2.4.6 Site Stratigraphy

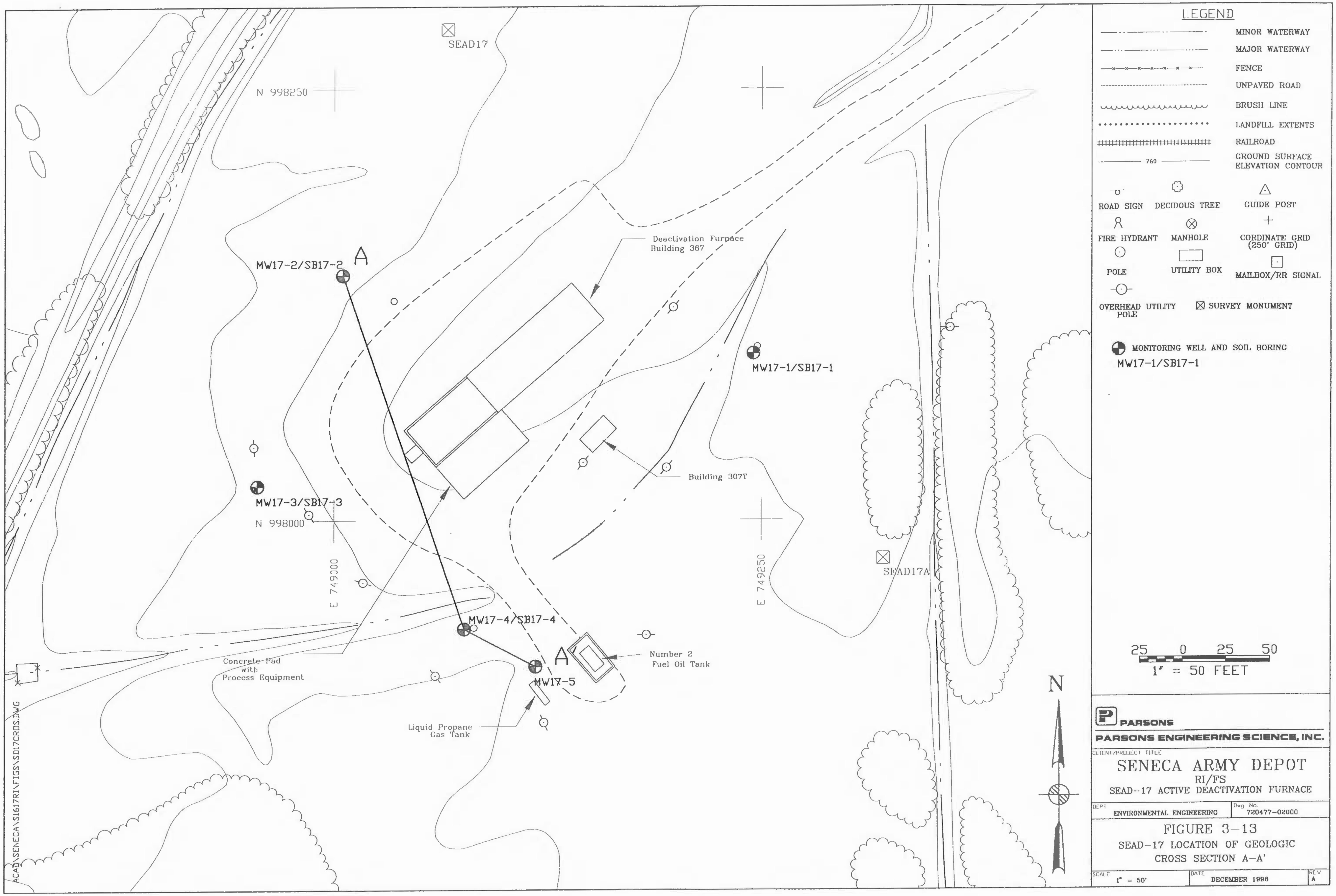
One geologic cross-section was constructed for the site. The location of the cross-section, A-A', is shown in Figure 3-13. Cross-section A-A' shows the consistent till, weathered shale, competent shale stratigraphy beneath the site based on data from borings and monitoring wells (Figure 3-14). The section also shows the local bedrock high near MW17-4. The sections were drawn to provide a somewhat detailed view of the subsurface stratigraphy by intersecting as many data points (i.e., soil borings or monitoring wells) as possible while maintaining a uniform direction for the cross-section.

3.2.5 Geophysics

3.2.5.1 Seismic Refraction Survey

Prior to beginning any of the subsurface investigations, a seismic refraction survey was performed along 4 profiles at SEAD-17. The results of the seismic refraction survey performed at SEAD-17 are listed in Table 3-5 and the locations of the individual seismic transects are shown in Figure 2-9. The seismic survey detected 4 to 7 feet of till, which is characterized by a 1,100 ft/sec to 1,400 ft/sec travel time, that was overlying bedrock, which was characterized by a 11,000 ft/sec to 12,600 ft/sec travel time. Saturated till was not detected at the time of the survey. Possible explanations as to why the water table was not detected are that the water table was within the bedrock, or the thickness of saturated till was small (less than 2 feet) and was not detectable by the seismic survey.

The seismic survey indicates that the bedrock surface slopes gently to the west or southwest, generally following the slope of the regional ground surface, it was later confirmed by data from borings. Based on this information, groundwater was expected to flow to the west or southwest, which was confirmed by groundwater topography maps for the site (Section 3.2.6.2).



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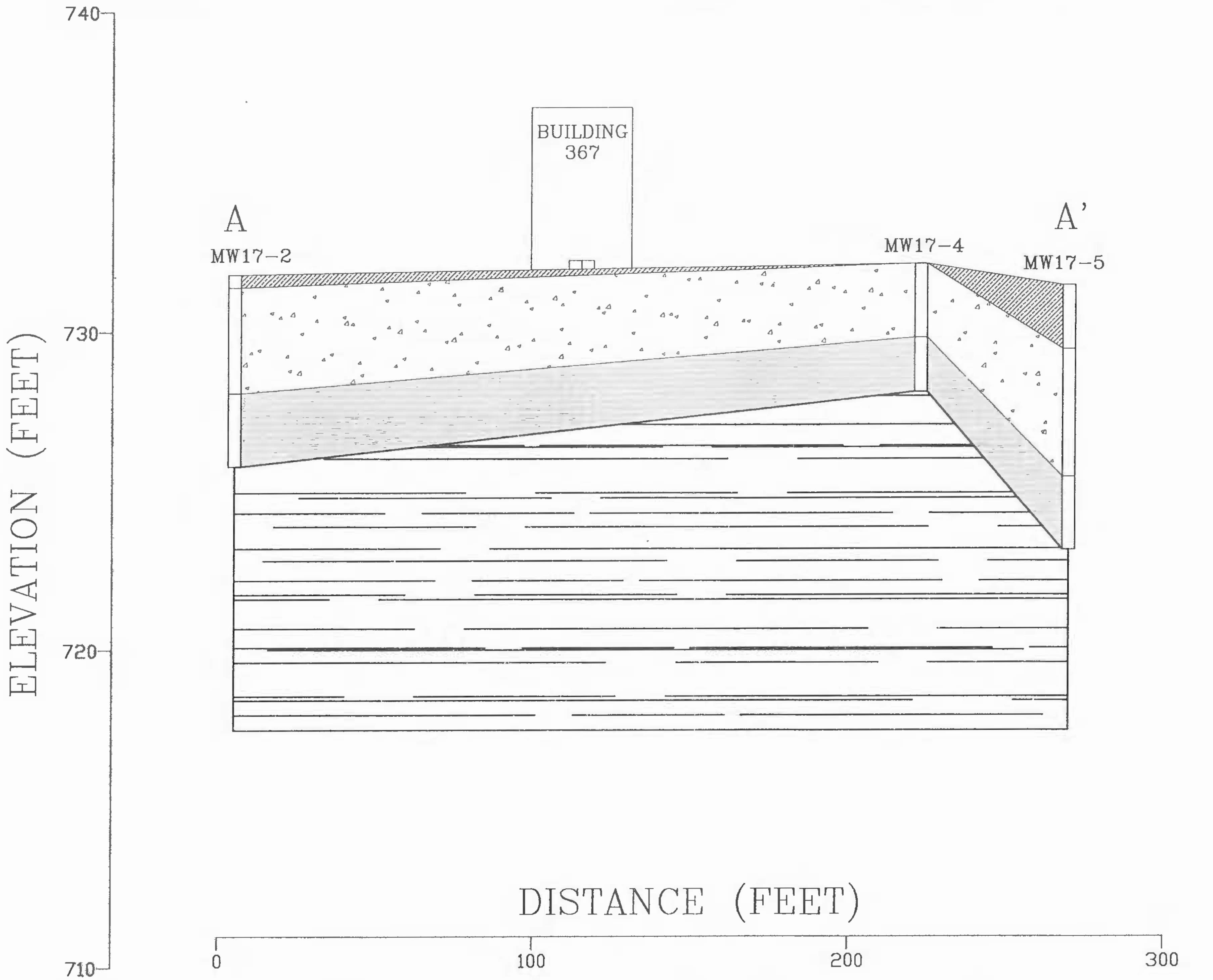
SEAD-17 ACTIVE DEACTIVATION FURNACE

DEPT	Dwg No.
ENVIRONMENTAL ENGINEERING	720477-02000

FIGURE 3-13
SEAD-17 LOCATION OF GEOLOGIC
CROSS SECTION A-A'

SCALE	DATE	REV
1" = 50'	DECEMBER 1996	A



▨ FILL

▒ WEATHERED SHALE

∴ GLACIAL TILL

☰ COMPETENT SHALE

HORIZONTAL SCALE – 1" = 40'
VERTICAL EXAGERATION = 10X
BUILDING VERTICAL SCALE IS ESTIMATED

ACAD\SENECA\16-17RIF\SD17AA.DWG

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DEPT.	Dwg No
ENVIRONMENTAL ENGINEERING	729895-01001

FIGURE 3-14
SEAD-17 GEOLOGIC CROSS-SECTION
A-A'

SCALE	DATE	REV
AS NOTED	JANUARY 1997	A

Table 3-5

SEAD-17 - Results of Seismic Refraction Survey

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Profile Number	Distance[1] on Profile (feet)	Ground Elevation[2]	Bedrock	
			Depth (feet)	Elevation (feet)
P1	0	99.0	6.6	92.4
	57.5	98.7	6.2	92.5
	115	98.9	7.3	91.6
P2	0	96.4	5.6	90.8
	57.5	95.6	4.4	91.2
	115	94.6	5.6	89.0
P3	0	97.3	5.4	91.9
	57.5	95.8	4.5	91.3
	115	96.1	5.3	90.8
P4	0	100.4	4.7	95.7
	57.5	100.7	4.7	96.0
	115	101.3	4.1	97.2

Notes:

[1] All distances are in feet.

[2] All elevations are relative to a temporary benchmark and are in feet.

3.2.6 Hydrogeology

3.2.6.1 Introduction

The hydrogeologic properties of the site were characterized in accordance with the investigation programs described in Section 2.0. This section presents the results of the investigation of the till/weathered shale and competent shale aquifers. It addresses topics such as groundwater flow directions, hydraulic conductivities, and velocity of groundwater.

3.2.6.2 Groundwater Flow Directions in the Till/Weathered Shale Aquifer

Several groundwater topography maps were constructed for SEAD-17 using depth to water table measurements in the till/weathered shale aquifer. The depth to water measurements for three separate events (April 4, 1994, August 29, 1996 and December 6, 1996) are shown in Table 3-6.

The groundwater flow direction in the till/weathered shale aquifer on the site is to the southwest based on the groundwater elevations measured in four monitoring wells on April 4, 1994 (Table 3-6). Recharge of water to the monitoring wells during sampling was generally fair to poor. The April 4, 1994 data set was not contoured because it contains only four data points.

The groundwater contour map for the August 29, 1996 data set, which contains five wells, also shows a southwesterly flow direction for groundwater (Figure 3-15). However, this data indicates that there is a local bedrock high near MW17-4. Groundwater elevations range from a high of 728.69 feet in the northeastern portion of the site to a low of 725.01 feet in the southwestern portion of the site. The horizontal groundwater gradient was calculated to be 0.01 ft/ft between two wells, MW17-1 and MW17-3. The saturated thickness of the aquifer is generally was between 1.7 and 3.7 feet, however, at the location of the local bedrock high it was less than 0.1 feet (Figure 3-15). This indicates that the flow of groundwater at the site is likely to be locally influenced by bedrock topography.

For comparison purposes, a second groundwater contour map was constructed based on depth to water measurements made on December 6, 1996 (Figure 3-16). This map shows a similar direction of flow (to the southwest), however, the saturated thickness of the till/weathered shale aquifer is significantly greater.

Table 3-6

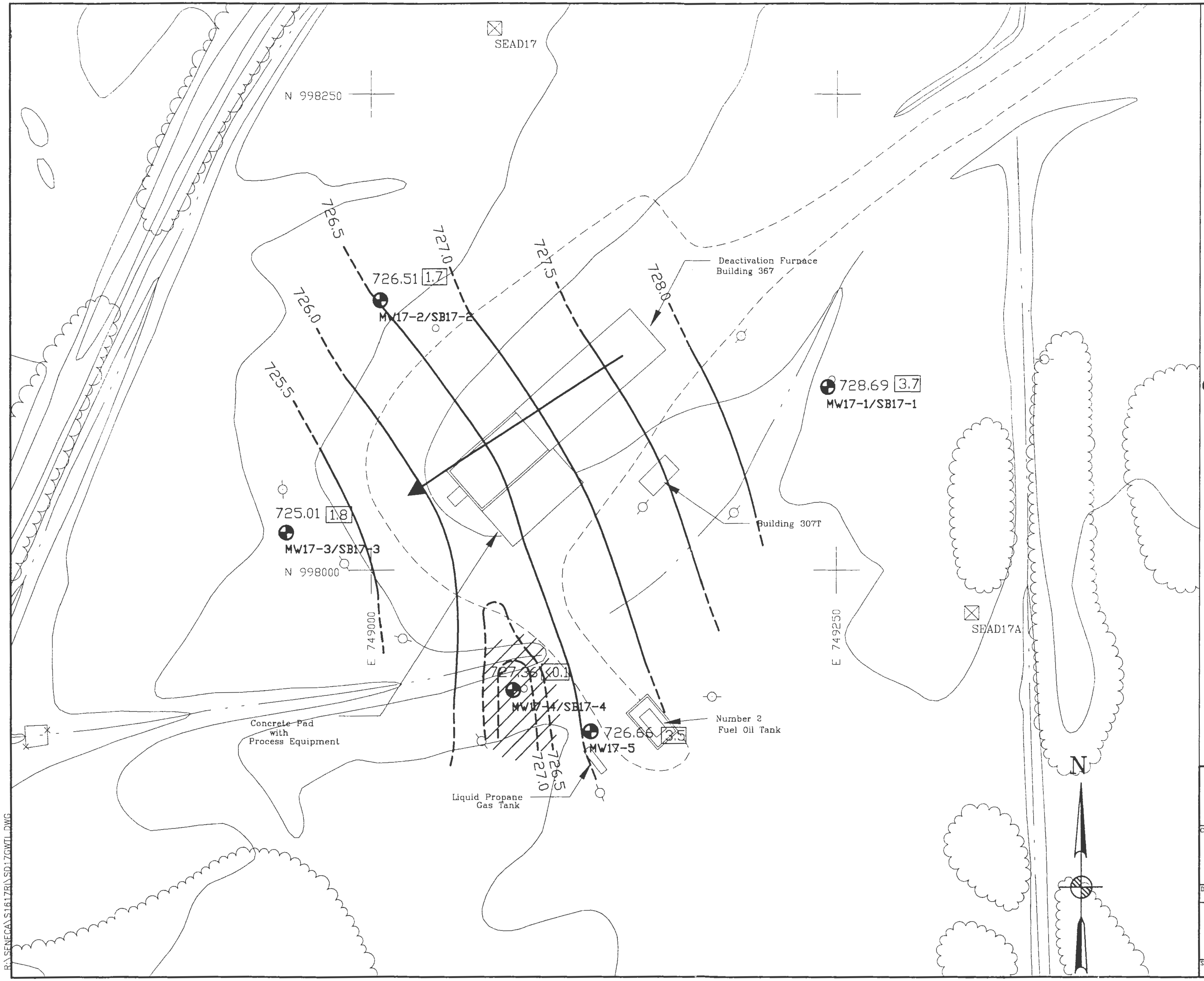
SEAD-17 - Water Table Elevations in Monitoring Wells

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Monitoring Well	Top of PVC Elevation (1) (feet)	April 4, 1994		August 29, 1996		December 6, 1996	
		Depth to Water (feet)	Water Table Elevation (feet)	Depth to Water (feet)	Water Table Elevation (feet)	Depth to Water (feet)	Water Table Elevation (feet)
MW17-1	736.33	2.80	733.53	7.64	728.69	3.01	733.32
MW17-2	733.75	3.19	730.56	7.24	726.51	3.45	730.30
MW17-3	732.15	2.38	729.77	7.14	725.01	2.47	729.68
MW17-4	734.59	3.00	731.59	7.23	727.36	3.13	731.46
MW17-5	733.58	NA	NA	6.92	726.66	2.65	730.93

Notes:

(1) Elevations are relative to the North American Vertical Datum (NAVD) 1988.
(2) April 4, 1994 data were collected as part of the ESI.
(3) NA = Not Available.



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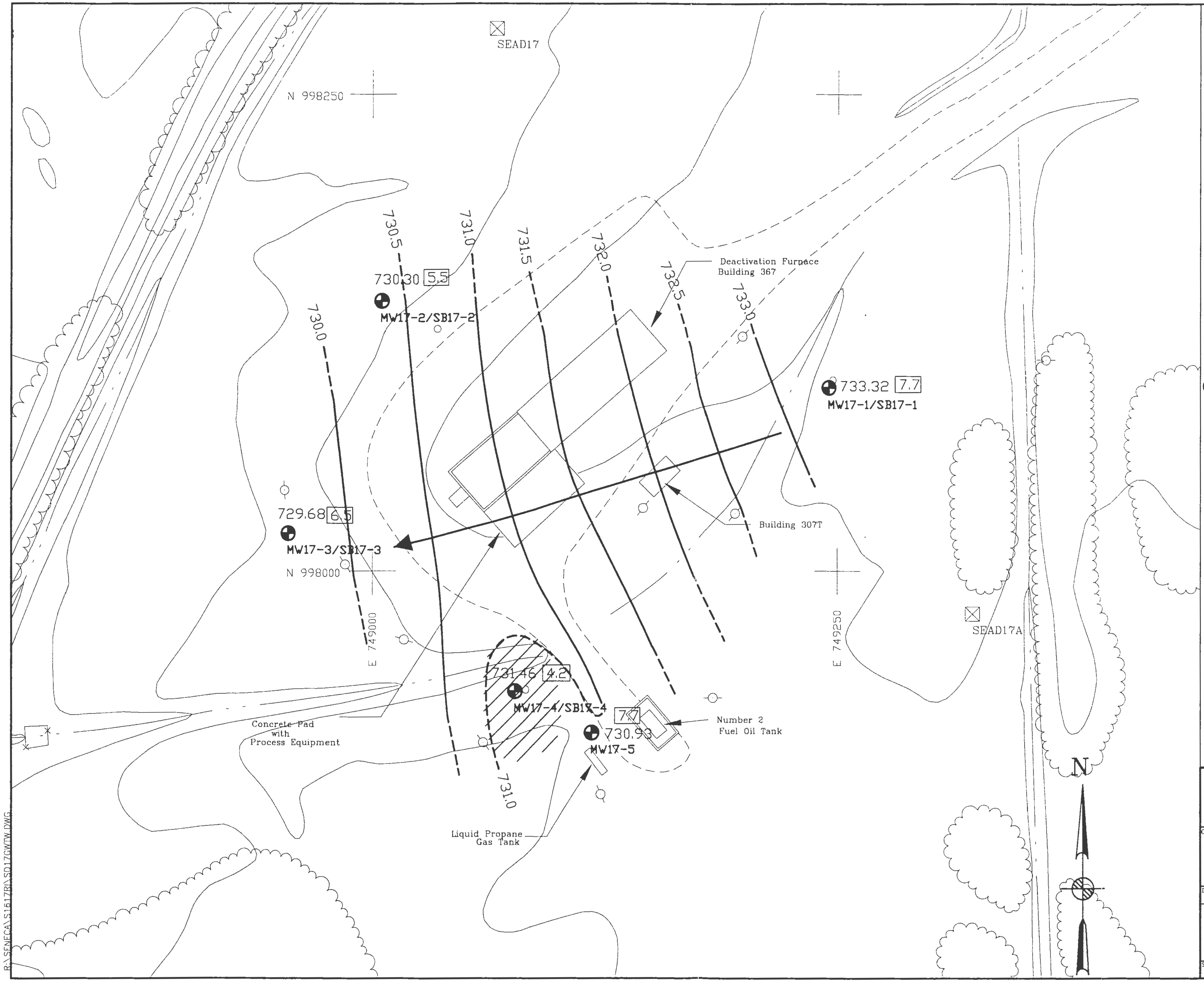
DEPT.	Dwg. No.
ENVIRONMENTAL ENGINEERING	729895-01004

FIGURE 3-15

SEAD-17 GROUNDWATER TOPOGRAPHY MAP FOR THE TILL/WEATHERED SHALE AQUIFER AUGUST 29, 1996

SCALE	DATE	REV
1" - 50'	MARCH 1999	A



LEGEND

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Dwg. No. 729896-01004

FIGURE 3-16

SEAD-17 GROUNDWATER TOPOGRAPHY MAP FOR THE TILL/WEATHERED SHALE AQUIFER DECEMBER 6, 1996

SCALE 1" - 50'

DATE MARCH 1999

REV A

To summarize, the groundwater data indicate that the flow directions and gradients are constant throughout the year at SEAD-17, and they are not significantly impacted by changes in saturated thickness.

3.2.6.3 Hydraulic Conductivities in the Till/Weathered Shale Aquifer

Horizontal hydraulic conductivities were determined for two till/weathered wells at SEAD-17 (MW17-1 and MW17-5). As discussed in Section 3.1.6.3, the saturated thickness in the till/weathered shale was small and thus, the magnitudes of the initial displacements in the slug tests were relatively small. Hydraulic conductivities for the two wells were calculated using the method described by Bouwer and Rice (1976). The remaining three wells did not have enough water to perform the slug test at the time of testing. The slug test data and hydraulic conductivity results are presented Appendix E.

Hydraulic conductivities on the site range from 2.9 x 10^{-3} cm/sec to 1.4 x 10^{-2} cm/sec as shown in Table 3-7. Published hydraulic conductivity values for till or representative materials are: 1) 0.49 m/day (5.67 x 10^{-4} cm/sec) for a repacked predominantly sandy till (Todd 1980), and 2) from 10^{-2} to 10^{-3} m/day (10^{-5} to 10^{-6} cm/sec) for representative materials of silt, sand, and mixtures of sand, silt, and clay (Todd 1980). No published hydraulic conductivity values for weathered shale were identified. While the measured values are slightly greater than the values cited in literature above, they represent a combined effect of the till and weathered shale.

3.2.6.4 Velocity of Groundwater in the Till/Weathered Shale Aquifer

Using Darcy's Law, the average linear velocity of groundwater in the shallow till/weathered shale aquifer was calculated. The velocity estimate was calculated using the geometric mean of the site hydraulic conductivity, an estimated effective porosity, and measured on-site groundwater gradients. A porosity estimate for weathered fissile shale with large amounts of silt in the interstices could not be located in the literature. Therefore, effective porosities for the till of 15 percent to 20 percent were used in the calculations.

The average linear velocity of groundwater in the till/weathered shale aquifer was calculated using the method described by Darcy's Law. The Darcy equation for the average linear velocity (V) of groundwater flow (Freeze and Cherry 1979) is:

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Table 3-7

SEAD-17 - Hydraulic Conductivity (K) Values for the Till/Weathered Shale Aquifer

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Location ID	Test Name	K (cm/sec)	K (ft/day)
MW17-1	MW171	2.94E-03	8.34E+00
MW17-2	no test (1)		
MW17-3	no test (1)		
MW17-4	no test (1)		
MW17-5	MW175A	1.35E-02	3.82E+01
MW17-5	MW175B	8.82E-03	2.50E+01
Summary Information:			
	Maximum:	1.35E-02	3.82E+01
	Minimum:	2.94E-03	8.34E+00
	Geometric Mean:	7.05E-03	2.00E+01
	Median:	8.82E-03	2.50E+01

Note:
(1) No test was performed because the water table was below the bottom of the well screen.
NA = Not Available

$$V = \frac{K \frac{dh}{dl}}{n}$$

where:

K is the horizontal hydraulic conductivity (cm/sec);
n is the estimated effective porosity (percent); and
dh/dl is the hydraulic gradient (ft/ft).

For the calculation of the groundwater flow velocity the input values used in the equation were: 1) a hydraulic conductivity of 7.1×10^{-3} cm/sec (20.1 ft/day), 2) an effective porosity of 15 percent (0.15) to 20 percent (0.20), and 3) a groundwater gradient of 0.01 ft/ft. Substituting the above-referenced values into the Darcy equation yields an average linear velocity of 1.0 ft/day (or 365 ft/year) at 20 percent effective porosity, and 1.3 ft/day (or 474.5 ft/year) at 15 percent effective porosity.

On the basis of the discussion above, it is likely that at certain times of the year, the saturated thickness of the aquifer will be small at SEAD-17, however, the data shows that the hydraulic gradient does not change, and thus the groundwater velocity is expected to be maintained throughout the year.

3.2.7 Ecological Investigation

3.2.7.1 Introduction

A qualitative characterization of the ecological communities was performed to determine the ecological community at SEAD-17. This assessment addresses potentially significant risks to the following biological groups and special-interest resources associated with the site: vascular vegetation, wildlife, aquatic life, endangered and threatened species, and wetlands. The focus of this assessment lies in the area of the Active Deactivation Furnace and the immediately surrounding vicinity. The Active Deactivation Furnace has been evaluated as a single site, with references being made to specific locations when it is appropriate. The aquatic study area included intermittent and perennial drainage ditches at the Active Deactivation Furnace. The terrestrial study area included the Active Deactivation Furnace and the area within a radius of approximately 2 miles from the site perimeter. Within the 2-mile radius, significant resources such as NYSDEC significant habitats; habitats supporting endangered, threatened, and rare species; species of concern; and state-regulated wetlands were identified. Within a smaller 0.5-mile radius of the site perimeter, the major vegetative communities, wildlife species associated with each cover type, and the value of the habitats to the associated wildlife were identified.

The information gathered for the ecologic assessment will be used inthe ERA component of the BRA to evaluate the likelihood that adverse ecological effects are occurring or may occur as a result of exposure to chemicals associated with the site based on a weight-of-evidence approach.

3.2.7.2 Site Habitat Characterization

Site-specific data were compiled regarding the types of habitats and wildlife species found in the site vicinity. No biological sample collection or inventory was conducted for the ecological investigation with the exception of minnow traps to help evaluate aquatic resources. The area considered likely to exhibit an interaction between elements of the local ecology and site-related contaminants occurs within a 2-mile radius of the site property. Due to land use patterns and geography within the 2-mile radius, evaluation of ecological resources and habitats is focused more on areas of potential exposure rather than on arbitrary distances or boundaries that lack a biological justification (EPA, 1989). Multiple site visits were conducted during October 1996 to evaluate the habitat conditions within the radius of concern. A general evaluation of ecological resources and land use patterns within a 2-mile radius was conducted in conjunction with the site inspection. A general vegetative cover type map was prepared for areas within a 2-mile radius of the site and is presented in Figure 3-17. A more detailed vegetative cover type map of the 0.5-mile radius is presented in Figure 3-18. Observations and assessments were concentrated on undeveloped areas, waterways, and wetlands on and adjacent to the site. Vegetative classifications used in this assessment are based on NYSDEC Natural Heritage Program *Ecological Communities of New York State* (Reschke, 1990)

Information presented in this section was acquired by a combination of literature review, file searches, telephone interviews, office visits, and site inspection. Information was obtained from various departments of the NYSDEC including the headquarters in Albany, NY, the Region 8 offices in Avon NY, the Wildlife Resources Center in Latham, NY, the NYSDEC Bureau of

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FIGURE 3-17

GENERAL VEGETATIVE COVERTYPE WITHIN 2.0 MILES OF SEAD-17

1" = 2000' | JANUARY 1997 | A

N

▤ OLD FIELDS AND SHRUB LANDS

▩ UNVEGETATED SURFACES (INCUDING ROADS,RAILROADS AND DEVELOPED LOTS)

░ PALUSTRINE FORESTED WETLAND (PFO)

▦ MOWN AREAS

▨ MIXED NORTHERN HARDWOODS

+ AGRICULTURE

250 0 250 500
1″ = 500′

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FIGURE 3-18
DETAILED VEGETATIVE COVERTYPE
WITHIN 0.5 MILES OF SEAD-17

1″ = 500′ JANUARY 1997 A

Monitoring and Assessment Ambient Surface Water Monitoring Program, and the Rotating Intensive Basin Survey. Information was also obtained from the Albany headquarters of the New York State Department of Health (NYSDOH), the State University of New York College of Environmental Science and Forestry (SUNY ESF), Cornell University, the US Fish and Wildlife Service (USFWS), the US Geological Survey Water Resources Division, and from publications of the Society of American Foresters. Site-specific resource information was acquired from the Seneca Army Depot *Natural Resources Management Plan* (SEDA, 1992c) and *Wetlands, Fish and Wildlife Plan* (SEDA, 1995). Regional information was obtained from the USGS 7 1/2 minute Romulus and Ovid, NY topographic maps; New York State Article 24 Freshwater Wetlands maps; the US Fish and Wildlife Service National Wetlands Inventory the US Department of Agriculture (USDA) Natural Resources Conservation Service (formerly, Soil Conservation Service); and the US Commerce Department *Climatic Atlas of the United States* (US Department of Commerce, 1983).

3.2.7.2.1 Regional Climate

Weather conditions in Seneca County exhibit seasonal fluctuations in temperature, precipitation, and prevailing winds. The climate in the region consists of moderately cold winters and warm, humid summers. The region exhibits a frost-free season of 135 days and a growing season of approximately 165 to 180 days (NOAA, 1990). Lake Ontario has a regional moderating effect on both daytime highs and nighttime low temperatures. Frost-free season length increases with proximity to the lake. Monthly precipitation in Seneca County is relatively uniform with no well-defined wet or dry seasons. The lightest precipitation commonly occurs in winter and the heaviest in late spring to midsummer. In 7 years in 10, total annual precipitation ranges from 26.5 to 37.5 inches. Rainfall during the May through September growing season is ordinarily 14.5 to 15.5 inches. Summer temperatures of 90⑤F or higher occur from 8 to 15 days in most years, mostly in June, July, and August. Average seasonal snowfall is 60 to 65 inches. Most days from early December through mid-March have at least 1 inch of snow cover on the ground (USDA, 1972).

3.2.7.2.2 Terrestrial Physical Characteristics

The Seneca Army Depot is situated due west of the village of Romulus, NY and 12 miles south of the villages of Geneva and Seneca Falls, NY. The site lies within the area described in the *Atlas of Forestry in New York* as the 1,400,000-acre Eastern Lake Plains region at the edge of the Allegheny Plateau (Society of American Foresters, 1973). The Allegheny Plateau exhibits irregular and broadly rolling topography in a complex pattern of high, rounded ridges flanked by steep, irregular valleys with elevations ranging from 500 to 2,500 feet. The Seneca Army Depot occupies 10,587 acres of a high, broad plateau separating Cayuga Lake, to the east, and Seneca Lake, to the west. Topography across the depot slopes gently from 765 feet at the southeast corner to 585 feet at the northwest corner.

The SEAD-17 site consists of an essentially flat fill area measuring roughly 350 feet by 350 feet, a total area of approximately 2.8 acres. The site is occupied by the deactivation furnace (building 367). The surface of the site exhibits very poor soil development and consists mostly of gravel and crushed shale, along with concrete and asphalt pavement. Topography surrounding the site is graded essentially flat to facilitate vehicular access.

Four watersheds are present on the depot (USDA, 1989). Kendaia Creek drains the central portion of the site westward into Seneca Lake. Reeder Creek drains the northwest and north-central regions of the facility. The northeast portion of the site drains into Kendig Creek, which flows north into the Cayuga-Seneca Canal. The southern part of the depot is drained by Indian Creek, which empties into Seneca Lake near Sampson State Park. The SEAD-17 site is located in the headwaters region of the Kendaia Creek watershed.

The site is filled and graded, allowing no standing water to accumulate on the ground surface. Surface water runoff is collected primarily in a ditch that carries surface runoff to the southwest. The ditch is tributary to Kendaia Creek at a point approximately 700 to 800 feet southwest of the site.

3.2.7.2.3 Land Use and Vegetative Cover

Land use at the depot is controlled by the facility mission. The entire facility has restricted access and is surrounded by chain-link fencing topped with barbed wire. The depot has a roadway network consisting of paved macadam, concrete, and gravel roads totaling approximately 141 miles.

Land use is divided into three categories at the depot. The Main Post accounts for 9,832 acres and consists of an exclusion area containing partially buried, reinforced concrete igloos, general storage magazines, and warehouses. The cantonment areas of the facility consist of the North and South Posts. The North Post, at the north end of the Main Post, includes troop housing, troop support, and community services. The South Post is located in the southeast portion of the facility near

Route 96 and is a developed area containing warehouses, administration buildings, quarters, and community services.

SEAD-17 is located at the western edge of the South Post area and adjoins the Main Post (ammunition area) perimeter fence. Land use at SEAD-17 consists of an abandoned building, storage lots, and derelict structures. Access to the site is restricted by perimeter chain link fencing.

The vegetative communities within the 0.5-mile study area are predominantly upland cover types unevenly distributed among the developed areas of the South Post. Vegetation and land use within the 0.5-mile radius study area are depicted in Figure 3-18. Cover types include mown lawns, old fields, shrublands, and deciduous forest. Unvegetated areas consist of open storage lots, railroads, paved roads, and buildings. Unvegetated corridors are maintained by herbicide application along the railroad tracks adjacent to the site.

On-site vegetation is sparse. Only a few specimens of common weeds have been able to establish root systems in the compacted fill soils at the site. No shrub or tree strata are present. Vegetation consists of grasses and early successional herbaceous species, primarily spotted knapweed (*Centaurea maculosa*), orchard grass (*Dactylis glomerata*), and various other grasses. These species occupy approximately 5 percent of the ground surface of the site. A listing of observed plant species and community associations at the site and within the 0.5-mile study area is presented in Table 3-11.

The types and distribution of vegetative communities surrounding the site result from decades of human modification of the environment of South Post and the ammunition area (Main Post) (SEDA, 1992a, c). Mowing, drainage diversion, building construction, landscaping practices, forestry practices, plantations, and herbicide application all control the composition of vegetation surrounding the site. The following sections describe the vegetation and ecological community types that were observed within the 0.5-mile study area. Classification of the communities is presented consistent with the approach presented in *Ecological Communities of New York State* (Reschke, 1990).

Upland Forest Communities

Appalachian Oak-Hickory Forest. This cover type represents a relatively minor component within the 0.5-mile study area in small, undisturbed remnant forests, bisected by ammunition area roads. These forests usually exhibit nearly complete canopy cover; abundant mast-bearing trees; and a shaded, sparse understory. The oak-hickory forests within the subject area are composed of northern red oak (*Quercus rubra*), white oak (*Quercus alba*), shagbark hickory (*Carya ovata*), and black walnut (*Juglans nigra*). The shrub stratum is dominated by saplings of these species as well as red maple (*Acer rubrum*), hawthorn (*Crataegus* sp.), butternut (*Juglans cinerea*), and vines of wild grape (*Vitis* sp.), poison ivy (*Toxicodendron radicans*), and raspberry (*Rubus idacus*).

Successional Northern Hardwoods. Successional northern hardwoods are present in areas where sufficient time has elapsed since disturbance to facilitate the development of a dense overstory canopy (75 percent cover). Particularly even-aged stands of red maple within this forest type are possibly deliberate plantations. Dominant overstory trees are red maple, eastern cottonwood (*Populus deltoides*), and northern red oak.

Conifer Plantation. The single occurrence of this vegetation type consists of a tamarack (*Larix laricina*) monoculture plantation located between the ammunition area roads B9 and C1, near the western fringe of the 0.5-mile radius. Small diameter tamaracks closely spaced at intervals occupy a plot in the area between the roadways. Close spacing and invasion of the understory by oldfield species appears to be limiting the prospects for this stand to mature into a significant covertype. While some scattered tamarack are present in surrounding cover types, they are apparently not vigorous enough to compete with fast-growing oldfield species and are exhibiting sparse new growth.

Deciduous tree plantation. Plantations of butternut and red maple appear to have been planted in the past, probably to create vegetative diversity and forage. Butternut stands, because of phytotoxins in the husks of their fruit, deter plant growth and exhibit a suppressed understory. Much of the shrub layer under the butternuts consists of only one species, raspberry, which appears to tolerate the altered soil chemistry.

Terrestrial Cultural Communities

Paved Roads and Mowed Roadside. Each of the ammunition area roadways has a paved width of 12 feet and has a mown and cleared margin of approximately 30 feet in width. Vegetative growth along site roads is maintained by mowing to provide suitable visibility and access, and to serve as fire breaks. No overstory or shrub layer is present within 30 feet of each edge of the asphalt pavement. Herbaceous growth is limited to grasses, sedges, and forbs able to withstand several mowings through the growing season.

Abandoned Structure Interior/Exterior. The abandoned building at SEAD-17 provides nesting habitat for barn swallows, roosting sites for bats, and shelter for small mammals. No other habitat utilization of the abandoned building was observed.

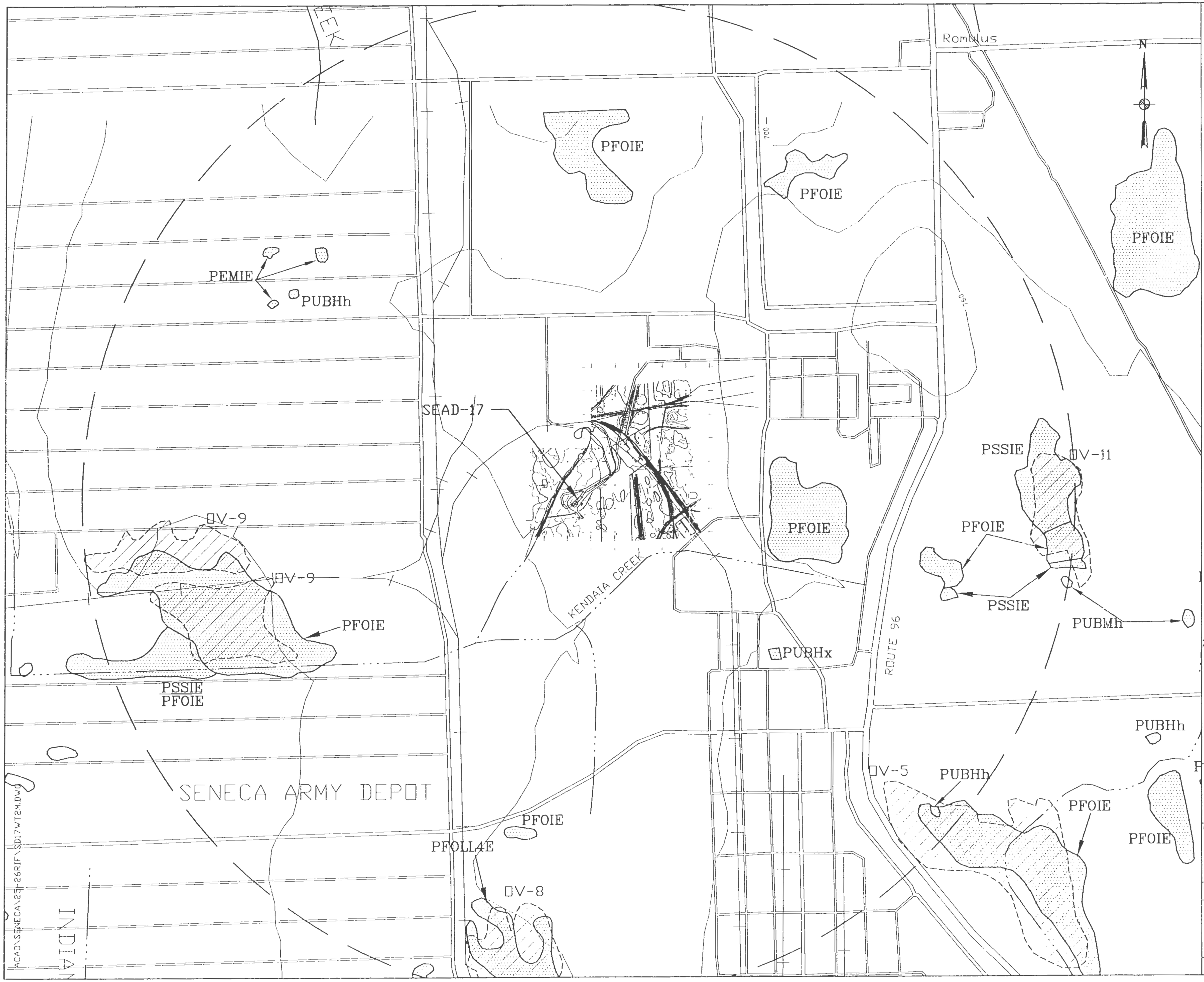
Ore Piles. Large ore piles consisting of ferro-manganese boulders/cobbles are present along the railroad sidings nearly 0.5 mile from the site. These ore piles offer no substrate for vegetation and are generally barren. Interstices near the ground surface may be exploited as shelter by small mammals. No significant habitat opportunities are otherwise offered in and around the ore stockpiles.

Railroads. Railroad tracks in the vicinity of the site were observed as being hunting grounds of red-tailed hawk and great horned owl during the field visits. Prominent perches adjacent to railroad corridors were occupied by these birds frequently during the site visits. Railroads apparently serve as trails for nocturnal creatures, as tracks and scat of skunk, raccoon, fox, and opossum were observed frequently. Poor rooting substrate and herbicide application suppress vegetation along the tracks and shoulders.

Palustrine Communities

The revised NYSDEC 1985 Article 24 Freshwater Wetlands map (Ovid, NY quadrangle) and USFWS National Wetlands Inventory (USFWS, 1991) map identify 32 freshwater wetlands within a 1-mile radius of the site. These wetlands are shown in Figure 3-19.

The nearest wetland (OV-8) identified on the 1985 NYS Article 24 Freshwater Wetlands map is located approximately 2,000 feet downstream, west of the site. Another NYS designated wetland (OV-5) occurs within the 0.5-mile radius study area, but is located outside the perimeter fence and



LEGEND

1.0 MILE BOUNDARY

ROADS

WATERWAY

PUBHh FEDERAL WETLANDS WITH CLASSIFICATION TYPE AS SPECIFIED IN SOURCE 2.

ΟV-11 STATE WETLANDS

SOURCES:

1. NYSDEC 1985 ARTICLE 24 FRESHWATER WETLANDS MAP (OVID, NY QUADRANGLE)
2. U.S. FISH AND WILDLIFE SERVICES NATIONAL WETLANDS INVENTORY MAP OVID, NY QUADRANGLE (1991)

500 0 500 1000
1" = 1000'

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FIGURE 3-19
WETLANDS WITHIN 1.0 MILE RADIUS
OF SEAD-17

1" = 1000'	JANUARY 1997	A

occurs in an apparently upgradient position located on the opposite side of Route 96 from the SEAD property. A portion of NYS designated wetland OV-7 occurs within 1 mile of the site.

The USFWS NWI map depicts four wetland environments within 0.5 mile of the site and an additional 25 wetlands within a 1-mile radius. Wetlands systems within the 1-mile radius consist of palustrine forested, scrub-shrub, and emergent vegetative types and open water wetlands exhibiting several vegetative subclasses and hydrologic regimes.

Shallow emergent marshes, forested wetlands, and shrub swamps are depicted on **Figure** 3-19. Palustrine emergent marshes within 0.5 mile of the site are limited to the fringes of streams and ditches and result from diversion of naturally occurring drainage patterns. Forested wetlands result from disruption of local drainages and flooding caused by beaver dams.

Riverine Communities

The headwaters of Kendaia Creek are present in the site vicinity, approximately 800 feet to the south of SEAD-17. The creek is a first-order stream with a modified dendritic drainage pattern that drains to the west, across the ammunition area, then into Seneca Lake at Pontius Point. The upper reaches of Kendaia Creek have been modified (channeled and straightened) to facilitate better surface water runoff from the South Post. Unnamed tributaries from the SEAD-17 site contribute to the upper reaches of Kendaia Creek at the point where the creek enters the Ammunition Area (Main Post) from the South Post.

The watershed land use at the headwaters of the creek (South Post) is low-density industrial complex with maintained grades, stable soils, and adequate storm sewers, with little erosion potential. Further downstream, development is limited to ammunition storage bunkers in the ammunition area (Main Post). Approximately 500 feet downstream of the ammunition area/South Post fence, the creek is impounded by a series of three beaver dams.

Ditch/Artificial Stream. Kendaia Creek exhibits markedly different physical characteristics in modified and undisturbed sections. The upper, channelized sections are lined with steep unconsolidated banks of crushed shale fill. Canopy cover in the channelized portion is absent. Estimated stream width varies from 10 to 20 feet with depths ranging from 2 to 4 feet. Less than 10 percent of the substrate consists of rubble, gravel, or other stable habitat. Due to a series of three beaver dams downstream, the upper reaches of the creek are impounded into a pool condition

The wildlife within 0.5 mile of the site consists of upland species, particularly those favoring old fields and shrublands and freshwater wetlands since these are abundant habitats in the study area. The mixture of these habitats with small woodlots and tree rows provides ideal habitat for white-tailed deer, which are common throughout the depot. Many non-game species also are present in the depot and potentially utilize habitats within the 0.5-mile study area.

Tracks, presumed to be of eastern coyote, coy-dog, or feral dog, were observed along the railroad sidings, west of the site. (While their tracks are often indistinguishable, no domestic dogs remain on the South Post since base closure.) Tracks of white-tailed deer, raccoon, and rabbit also were observed adjacent to the site. Wildlife evidence and direct observations made during site visits are presented in Table 3-11.

3.2.7.2.7 Endangered Species and Significant Habitats

The NYSDEC Natural Heritage Program Biological and Conservation Data System identifies no known occurrences of federal- or state-designated threatened or endangered plant or animal species within a 2-mile radius of the site. No species of special concern are documented within the depot property. Field investigation of the site determined that the surrounding area is highly modified and has a disturbed ecology resulting from management consistent with mission activities. Highly disturbed sites are characteristically colonized by pioneer species and agricultural "weeds" and do not typically support rare or endangered species. No rare or endangered plant species were observed during the site reconnaissance.

3.2.7.2.8 Habitat Assessment

Resource Values to Wildlife

The 9,832-acre Main Post is the focus of wildlife and forestry management practices being conducted at the depot. Wildlife management efforts focusing on waterfowl, songbirds, and game populations have been conducted for many years.

Overall, the small and highly-dissected meadow, forest, and oldfield habitats in the study area provide marginal habitat value. Extensive development and human traffic within the South Post likely deter wildlife utilization. Proximity to extensive mixed cover types of the Main Post probably enhances these habitats as foraging areas somewhat, and contributes diversity to the local environment.

The South Post is largely developed land that experiences indirect effects of the Main Post wildlife management strategies. For example, while the Main Post and South Post are separated by a chain link fence, breaches in the fence were observed to provide access to nocturnal grazing areas on South Post. White-tailed deer move to the South Post to graze lawns and gardens at night and return to the relative safety of the Main Post during the daylight hours. Many small mammals probably find the fencing no great barrier and may forage in a similar manner. Wildfowl and songbirds also may seek the Main Post solitude during the mid-day and seek foraging opportunities in the South Post during the early morning and evening. Landscaped lawns with exotic plantings, bird feeders, and garbage dumpsters offer foraging opportunities not available in the undeveloped Main Post. Wildlife management practices on the Main Post therefore have a spillover effect into the 0.5-mile study area of this ERA.

Wildlife and aquatic life that were observed within the 0.5-mile radius are presented in Table 3.11 In general, common wildlife species exploiting oldfield, successional forest, mature hardwood forest, and wetlands potentially occur within 0.5 mile of the site. Kendaia Creek and unnamed tributaries occur within the radius of concern and support a permanent aquatic community.

The habitat value of the SEAD-17 site itself is considered marginal. The surrounding perimeter fence excludes large mammals such as white-tailed deer, fox, and coyote. The gate over the access road reaches to within 6 inches of the ground surface and offers egress by small mammals such as rabbits, raccoons, and woodchucks (*Marmota monax*). No burrows were observed on the site. Mice, voles, and shrews would not be excluded by the perimeter fence. No mature trees are available for bird nesting or for dens. Ground-nesting birds preferring exposed gravel substrates, such as killdeer (*Charadrius vociferus*) may find suitable nesting conditions on the site, whereas tall grasses are too sparse to offer nesting habitat for ground nesters requiring concealment. Abundant evidence (tracks) of small mammals was observed in the pallet yard 300 feet northeast of the site. Human activity on and around the site probably discourages habitat utilization by some species.

Resource Value to Humans

The Seneca Army Depot represents a unique opportunity for wildlife and pest control research in New York state due to its large size and continuous perimeter fencing. The Depot property represents significant value to humans resulting from decades of wildlife management and scientific research. The NYSDEC has used the depot white-tailed deer population to develop population, growth, and reproduction models. Currently a 3-year Cornell University/NYSDEC white-tailed deer immuno-contraception study is being conducted with a captive herd in the Q area of the Main Post. NYSDEC biologists participate in annual harvests by inspecting field-dressed deer for disease and parasites, aging specimens, and measuring beam diameter (SEDA, 1992c). NYSDEC conducted studies in the 1960s on fox reproduction inhibition using diethyl stilbestrol (DES) to control the spread of rabies. Cornell University entomologists have conducted studies on the ability of northern corn rootworm to traverse areas of non-croplands at the Depot (SEDA, 1992c).

Consumptive use of wildlife consists of hunting of upland birds, predators, waterfowl, and white-tailed deer. Harvest of deer is closely monitored to maintain the population below carrying capacity of the Depot habitat (SEDA, 1995). Hunting on the property is presently limited to current and retired military personnel and limited numbers of guests. Hunting is conducted during both the Southern Zone archery and firearms hunting seasons in accordance with New York state regulations. Discontinuation of the military mission of the Depot may have significant impacts on the types and intensity of human utilization of wildlife resources in the future.

The consumptive wildlife resource value of the SEAD-17 property to humans is considered non-existent, due to the Post being posted and patrolled against unauthorized entry. Additionally, land use in the immediate vicinity of SEAD-17 is inconsistent with consumptive wildlife uses by the general public. Future use scenarios for the South Post property (excluding complete abandonment) are not likely to increase the suitability of habitat or wildlife resource value in the vicinity of SEAD-17.

Currently much of the South Post is vacant and access to the Depot is still restricted, thus limiting participation in non-consumptive wildlife uses. Evidence of non-consumptive wildlife resource utilization, such as bird watching, wildlife observation, photography, and amateur study, was not observed during the site inspection but is presumed to occur in the study area. The white-tailed deer population is an unusual herd that has an important aesthetic value. Due to breaches in the Main Post fence, white-tailed deer can be commonly observed in the South Post.

The drainages adjacent to the site do not provide exploitable fisheries resources. No recreational fishing resources are utilized within the 0.5-mile study area.

4.0 NATURE AND EXTENT OF IMPACTS

Data quality objectives for this RI follow the guidance described in Data Quality Objective (DQO) for Remedial Response Activities: Development Process (US EPA, March 1987) that is described in the approved Generic Installation RI/FS Workplan for SEDA. This DQO document has been replaced by the Data Quality Objectives Process for Superfund: Interim Final Guidance (USEPA, 1993). Although the workplans for this site referenced the earlier DQO document (USEPA, 1987), a review of the Interim Final Guidance (USEPA, 1993) indicates that the development of the field investigation program for SEAD-16 and SEAD-17 essentially followed the steps outlined in the Interim Final Guidance. These steps include development of a conceptual site model, defining the exposure scenarios, determining the regulatory objectives, defining the boundaries of the study area, and developing a judgmental sampling plan for the field investigation program. The non-probabilistic approach to developing a sampling program was used because the objective of the program was to establish that a threat exists in a complete exposure pathway by confirming the presence of a hazardous chemical substance associated with the site, based on visual and historical information on the chemical sources. The specific locations of chemical impacts were identified during the ESI and from historical information about activities conducted at the sites. In order to maintain consistency between the Generic Installation RI/FS Workplan, the Scoping Plan for SEAD16 and SEAD-17, and the reports prepared for SEDA, this report will continue to reference the earlier DQO document.

4.1 SEAD-16

4.1.1 Introduction

This section presents the analytical results for all media sampled at SEAD-16. Data from the ESI and the RI investigations have been merged into a single data base and they are discussed as a whole in this RI report.

The investigation activities performed for the RI generated Level I and Level IV analytical data. These data categories are described in the earlier DQO document (USEPA, 1987). The Interim Final Guidance (USEPA, 1993) describes two data categories, screening data with definitive confirmation, and definitive data. These two categories are associated with specific quality assurance and quality control elements. The Level I and IV data meet the applicable QA/QC requirements for screening and definitive data which are presented in the Interim Final Guidance. To maintain consistency between the workplans and reports prepared for SEDA, the data categories will continue to be referred to using "Level" terminology.

The Level I data was gathered primarily for health and safety reasons during soil boring and monitoring well sampling activities using field screening instruments (such as a Thermoenvironmental, Inc. OVM 580B and a Miniram PDM-3 dust monitor). Level IV analyses were used to generate data that would positively identify constituents at SEAD-16, and define the extent of their impacts in seven types of media. The seven types of media at SEAD-16 are as follows:

- Surface Soil;
- Subsurface Soil;
- Groundwater;
- Surface Water;
- Sediment;
- Indoor Air; and
- Building Materials/ Floor Samples.

For each of these media except indoor air, the parameter groups analyzed for include: VOCs, SVOCs, pesticides and PCBs, metals, nitroaromatics, nitrate-nitrogen, total petroleum hydrocarbons (groundwater only), and herbicides (soil and groundwater only for the ESI); the VOC and SVOC analyses also included the identification and quantification of tentatively identified compounds (TICs) (refer to Appendix G). Building material samples and pipe samples were collected from inside the Abandoned Deactivation Furnace Building (S-311) and the Process Support Building (366) and also analyzed for the presence of asbestos as part of the ESI and the RI. Indoor air samples from Building S-311 were analyzed for asbestos, metals, mercury, and SVOCs.

The Level IV analytical results are discussed first by media and then by constituent group. The analytical results are summarized on data tables and, where appropriate, maps are used to show the horizontal and vertical distribution of constituents of concern at the site. Complete analytical data tables are in Appendix G.

4.1.2 Building Materials

Eight building material samples, six soil samples, two furnace scale samples, and two standing water samples were collected from the interior of the Abandoned Deactivation Furnace (Building S-311) during the ESI field program. Sixteen of the samples, which include the building material, soil, and furnace scale samples, were also analyzed for asbestos and are designated as AS16-1 through AS16-16. Eight floor samples, which are designated as FS16-1 through FS16-8, and two standing water samples, SW16-1 and SW16-2, were also collected from Building S-311 during the ESI and submitted for the chemical analyses described in Section 2.2.4.1. The results of the chemical analysis for the standing water samples are reported later in Table 4-21, which presents surface water data for SEAD-16. During the RI field program, 19 samples, AS16-17 through AS16-36, were collected from Building S-311 and analyzed for asbestos.

The Process Support Building (Building 366) was investigated only during the RI field program. Two propellant residue samples (BS-10 and BS-11), one floor sample (FS-50), and eight building material samples (AS16-26, AS16-37 through AS16-43) were collected from the building. The propellant residue samples and floor sample were submitted for the chemical analyses described in Section 2.2.4.1.

For this discussion, all of the samples described above will be referred to as building material samples. Samples that were submitted for chemical analyses included the eight floor samples and the standing water samples from Building S-311, and the propellant residue samples and floor sample (including one duplicate sample) from Building 366. Results of the chemical analyses for these 14 samples will be discussed in the following sections. The samples which were analyzed for asbestos will be discussed in Section 4.1.2.7. Summary statistics for the building material samples are presented in Table 4-1.

4.1.2.1 Volatile Organic Compounds

Seven VOCs were detected in the building material samples collected from both buildings at the site (Table 4-2). The VOCs were detected in the two samples, BS-10, which is a propellant sample from Building 366, and FS-50, which is a floor sample from Building 366. All the VOCs were detected at concentrations far below their respective NYSDEC TAGM values.

No VOCs were detected in the two standing water samples collected from Building S-311.

4.1.2.2 Semivolatile Organic Compounds

Twenty-seven SVOCs were detected in the building material samples (Table 4-2). Ten compounds, mostly PAHs, were detected at concentrations above their respective NYSDEC TAGM values. Benzo(a)pyrene was detected in six samples at concentrations above the TAGM value. The maximum concentration of 1500 J µg/kg was detected in FS-16-7, which is from the floor of Building S-311. Benzo(a)anthracene and chrysene were detected in the three samples FS16-3, FS16-7, and FS16-8 at concentrations above the TAGM values. Phenol was also detected in the samples FS16-1, FS16-3, and FS16-4 at concentrations above the NYSDEC TAGM of 30 µg/kg. The remaining compounds were detected in only one or two samples at concentrations above the TAGM values. The following PAH compounds are considered to be carcinogenic by the NYSDEC: benz(a)anthracene, benzo(b)fluoranthene, benzo(j)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, dibenz(a,h)acridine, dibenz(a,j)acridine, dibenz(a,h)anthracene, dibenzo(c,g)carbazole, dibenzo(a,e)pyrene, dibenzo(a,h)pyrene, dibenzo(a,i)pyrene, dibenzo(a,l)pyrene, indeno(1,2,3-cd)pyrene, and 5-methylchrysene. These compounds will be discussed as total carcinogenic PAHs in this report. The maximum total carcinogenic PAH concentration of 54,000 µg/kg was detected in BS-10, which is a propellant residue sample from Building 366.

2,4-Dinitrotoluene was detected in three samples and at a maximum concentration of 3,000,000 µg/kg.

No SVOCs were detected in the standing water samples collected from Building S-311.

4.1.2.3 Pesticides and PCBs

Twelve pesticides were detected in the building material samples (Table 4-2). All the compounds were detected at concentrations below their respective TAGM values at each location except one. Sample F16-8 exceeds its TAGM value for Aroclor-1254 by 400 ug/kg. The remaining PCB detections were below the TAGM value of 1,000 ug/kg.

No pesticides or PCBs were detected in the standing water samples from Building S-311.

4.1.2.4 Nitroaromatics

Three nitroaromatic compounds were detected in the building material samples (Table 4-2). The compound 2,4-dinitrotoluene was detected in eight of the samples, and the two highest concentrations (3,700,000 µg/kg and 19,000,000 µg/kg) were detected in BS-10 and BS-11, respectively. These are propellant samples collected from the vacuum system and receiving vats in Building 366.

The compounds 1,3,5-trinitrobenzene and 2,4,6-trinitrotoluene were also detected, but each in only one sample. The compound 1,3,5-trinitrobenzene was detected at a concentration of 220 J µg/kg in FS-50, which is a floor sample collected in Building 366. Also, 2,4,6-trinitrotoluene was detected at a concentration of 170 J µg/kg in FS16-1, which is a floor sample from Building S-311.

No nitroaromatic compounds were detected in the standing water samples.

Table 4-1
Summary Statistics for Building Materials

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

ameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
LATILE ORGANICS								
1-Trichloroethane	UG/KG	11	1	9%	7	7	7	0
2,2-Tetrachloroethane	UG/KG	11	0	0%				
2-Trichloroethane	UG/KG	11	0	0%				
Dichloroethane	UG/KG	11	0	0%				
Dichloroethene	UG/KG	11	0	0%				
Dichloroethane	UG/KG	11	0	0%				
Dichloroethene (total)	UG/KG	11	0	0%				
Dichloropropane	UG/KG	11	0	0%				
utanone	UG/KG	11	0	0%				
exanone	UG/KG	11	0	0%				
ethyl-2-Pentanone	UG/KG	11	0	0%				
tone	UG/KG	11	0	0%				
zene	UG/KG	11	0	0%				
modichloromethane	UG/KG	11	0	0%				
moform	UG/KG	11	0	0%				
momethane	UG/KG	11	1	9%	22	22	22	0
bon Disulfide	UG/KG	11	0	0%				
bon Tetrachloride	UG/KG	11	0	0%				
robenzene	UG/KG	11	0	0%				
roethane	UG/KG	11	0	0%				
roform	UG/KG	11	1	9%	14	14	14	0
oromethane	UG/KG	11	1	9%	22	22	22	0
romochloromethane	UG/KG	11	0	0%				
lbenzene	UG/KG	11	0	0%				
hylene Chloride	UG/KG	11	1	9%	7	7	7	0
ene	UG/KG	11	0	0%				
achloroethene	UG/KG	11	0	0%				
uene	UG/KG	11	1	9%	20	20	20	0
hloroethene	UG/KG	11	1	9%	13	13	13	0
yl Chloride	UG/KG	11	0	0%				
ene (total)	UG/KG	11	0	0%				
1,3-Dichloropropene	UG/KG	11	0	0%				
s-1,3-Dichloropropene	UG/KG	11	0	0%				
MIVOLATILE ORGANICS								
4-Trichlorobenzene	UG/KG	11	0	0%				
Dichlorobenzene	UG/KG	11	0	0%				
Dichlorobenzene	UG/KG	11	0	0%				
Dichlorobenzene	UG/KG	11	0	0%				

Table 4-1
Summary Statistics for Building Materials

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

ameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
oxybis(1-Chloropropane)	UG/KG	8	0	0%				
5-Trichlorophenol	UG/KG	11	0	0%				
-Trichlorophenol	UG/KG	11	0	0%				
Dichlorophenol	UG/KG	11	0	0%				
Dimethylphenol	UG/KG	11	0	0%				
Dinitrophenol	UG/KG	11	0	0%				
Dinitrotoluene	UG/KG	11	3	27%	200	3000000	1000967	1731214
Dinitrotoluene	UG/KG	11	2	18%	200	74000	37100	52184.48
hloronaphthalene	UG/KG	11	0	0%				
hlorophenol	UG/KG	11	0	0%				
ethylnaphthalene	UG/KG	11	6	55%	21	19000	3219.167	7731.226
ethylphenol	UG/KG	11	0	0%				
itroaniline	UG/KG	11	0	0%				
itrophenol	UG/KG	11	0	0%				
Dichlorobenzidine	UG/KG	11	0	0%				
itroaniline	UG/KG	11	0	0%				
Dinitro-2-methylphenol	UG/KG	11	0	0%				
romophenyl-phenylether	UG/KG	11	0	0%				
hloro-3-methylphenol	UG/KG	11	0	0%				
hloroaniline	UG/KG	11	0	0%				
hlorophenyl-phenylether	UG/KG	11	0	0%				
ethylphenol	UG/KG	11	0	0%				
itroaniline	UG/KG	11	0	0%				
itrophenol	UG/KG	11	0	0%				
naphthene	UG/KG	11	3	27%	23	4500	1694.333	2444.569
naphthylene	UG/KG	11	0	0%				
hracene	UG/KG	11	4	36%	22	2900	903.5	1365.604
zo(a)anthracene	UG/KG	11	8	73%	40	1600	405.125	582.773
zo(a)pyrene	UG/KG	11	10	91%	42	1500	307.5	481.042
zo(b)fluoranthene	UG/KG	11	10	91%	47	1600	352	494.692
zo(g,h,i)perylene	UG/KG	11	5	45%	61	870	297	342.437
zo(k)fluoranthene	UG/KG	11	8	73%	50	1600	401.5	546.417
ylbenzylphthalate	UG/KG	11	2	18%	55	54000	27027.5	38144.88
bazole	UG/KG	11	4	36%	21	740	205.25	356.559
ysene	UG/KG	11	10	91%	73	1900	471.3	657.629
n-butylphthalate	UG/KG	11	4	36%	50	950000	237612.5	474925
n-octylphthalate	UG/KG	11	0	0%				
enz(a,h)anthracene	UG/KG	11	2	18%	26	500	263	335.169
enzofuran	UG/KG	11	4	36%	22	1500	489.5	694.324

Table 4-1
Summary Statistics for Building Materials

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

ameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
thylphthalate	UG/KG	11	1	9%	530	530	530	0
ıethylphthalate	UG/KG	11	0	0%				
)ranthene	UG/KG	11	10	91%	99	3900	938.9	1389.387
)rene	UG/KG	11	3	27%	25	6100	2228.333	3363.615
.achlorobenzene	UG/KG	11	0	0%				
.achlorobutadiene	UG/KG	11	0	0%				
achlorocyclopentadiene	UG/KG	11	0	0%				
:achloroethane	UG/KG	11	0	0%				
:no(1,2,3-cd)pyrene	UG/KG	11	5	45%	39	450	206.4	201.297
)horone	UG/KG	11	0	0%				
litroso-di-n-propylamine	UG/KG	11	0	0%				
litrosodiphenylamine (1)	UG/KG	11	2	18%	450	200000	100225	141103.2
›hthalene	UG/KG	11	4	36%	19	1600	518	743.194
'obenzene	UG/KG	11	0	0%				
tachlorophenol	UG/KG	11	1	9%	220	220	220	0
ıanthrene	UG/KG	11	9	82%	64	22000	3059.333	7220.318
ıol	UG/KG	11	3	27%	81	37000	12410.33	21295.3
:ne	UG/KG	11	10	91%	95	5000	1032.5	1684.754
2-Chloroethoxy) methane	UG/KG	11	0	0%				
2-Chloroethyl) ether	UG/KG	11	0	0%				
2-Chloroisopropyl) ether	UG/KG	3	0	0%				
2-Ethylhexyl)phthalate	UG/KG	11	5	45%	52	5000	1458.4	2031.111
STICIDES/PCB								
-DDD	UG/KG	11	3	27%	3.1	35	14.433	17.842
-DDE	UG/KG	11	10	91%	6.3	750	116.69	229.577
-DDT	UG/KG	11	11	100%	6.1	940	283.309	359.068
rin	UG/KG	11	0	0%				
clor-1016	UG/KG	11	0	0%				
clor-1221	UG/KG	11	0	0%				
clor-1232	UG/KG	11	0	0%				
clor-1242	UG/KG	11	0	0%				
clor-1248	UG/KG	11	0	0%				
clor-1254	UG/KG	11	7	64%	36	1400	314.571	490.348
clor-1260	UG/KG	11	7	64%	37	630	144.286	215.336
ldrin	UG/KG	11	2	18%	4.2	28	16.1	16.829
losulfan I	UG/KG	11	2	18%	3.3	22	12.65	13.223
losulfan II	UG/KG	11	3	27%	3.4	5.7	4.333	1.21
losulfan sulfate	UG/KG	11	0	0%				
lrin	UG/KG	11	1	9%	9.2	9.2	9.2	0

Table 4-1
Summary Statistics for Building Materials

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

ameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
rin aldehyde	UG/KG	11	0	0%				
rin ketone	UG/KG	11	0	0%				
tachlor	UG/KG	11	0	0%				
tachlor epoxide	UG/KG	11	1	9%	2.6	2.6	2.6	0
hoxychlor	UG/KG	11	0	0%				
aphene	UG/KG	11	0	0%				
a-BHC	UG/KG	11	2	18%	2	3.7	2.85	1.202
a-Chlordane	UG/KG	11	8	73%	1.2	47	9.713	15.498
-BHC	UG/KG	11	0	0%				
a-BHC	UG/KG	11	0	0%				
ma-BHC (Lindane)	UG/KG	11	1	9%	0.93	0.93	0.93	0
ma-Chlordane	UG/KG	11	7	64%	2.1	36	8.886	12.462
HER ANALYSES								
osite Asbestos	%	14	0	0%				
osite Asbestos	%, +-5	2	2	100%	40	50	45	7.071
ysotile Asbestos	%	54	5	9%	35	65	50	11.18
ysotile Asbestos	%, > TH	5	5	100%	1	1	1	0
ysotile Asbestos	%, +-2.	2	2	100%	7.5	12.5	10	3.536
ysotile Asbestos	%, +-5	3	3	100%	20	30	26.667	5.774
ate/Nitrite-Nitrogen	MG/KG	11	11	100%	0.05	14200	1422.647	4243.916
ent Moisture (PEST/PCB)		3	3	100%	8	59	40.333	28.113
ent Moisture (SVOCs)		3	3	100%	8	58	40	27.785
ent Moisture (VOCs)		3	3	100%	6	60	40	29.597
ent Solids (Metals)		4	4	100%	41.2	91.5	62.75	23.617
ROAROMATICS								
5-Trinitrobenzene	UG/KG	12	1	8%	220	220	220	0
Dinitrobenzene	UG/KG	12	0	0%				
6-Trinitrotoluene	UG/KG	12	1	8%	170	170	170	0
Dinitrotoluene	UG/KG	12	9	75%	72	19000000	2527544	6296775
Dinitrotoluene	UG/KG	12	0	0%				
nino-4,6-Dinitrotoluene	UG/KG	12	0	0%				
nino-2,6-Dinitrotoluene	UG/KG	12	0	0%				
X	UG/KG	12	0	0%				
obenzene	UG/KG	4	0	0%				
X	UG/KG	12	0	0%				
yl	UG/KG	12	0	0%				
TALS								
minum	MG/KG	12	8	67%	2960	16500	9765	4188.72
imony	MG/KG	12	11	92%	11.2	1560	406.045	583.691

Table 4-1
Summary Statistics for Building Materials

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

ameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
enic	MG/KG	12	12	100%	1.3	47.3	12.308	13.08
ium	MG/KG	12	12	100%	88.2	40500	5888.85	11806.36
yllium	MG/KG	12	10	83%	0.09	1.1	0.413	0.307
mium	MG/KG	12	8	67%	0.41	127	32.681	47.628
cium	MG/KG	12	12	100%	586	215000	53539.67	60502.24
omium	MG/KG	12	8	67%	4.3	518	111.888	178.492
alt	MG/KG	12	12	100%	2.7	40.6	13.142	11.169
per	MG/KG	12	12	100%	90	81400	11997.26	24685.53
nide	MG/KG	12	6	50%	1.1	24.2	7.183	8.921
	MG/KG	12	12	100%	2690	79700	38400.83	25671.59
d Lead	MG/KG	12	12	100%	132	527000	82113.58	187799.4
gnesium	MG/KG	12	12	100%	2470	19700	11445	5847.35
ganese	MG/KG	12	12	100%	27.3	1040	422.775	251.512
cury	MG/KG	12	10	83%	0.1	39.3	7.466	13.466
kel	MG/KG	12	12	100%	2.1	154	53.892	51.496
ssium	MG/KG	12	12	100%	636	80600	9284.167	22625.68
nium	MG/KG	12	8	67%	0.72	5.8	1.873	1.65
er	MG/KG	12	4	33%	0.62	22.7	10.08	10.029
ium	MG/KG	12	12	100%	63.1	4440	1557.417	1734.633
llium	MG/KG	12	2	17%	0.38	1.4	0.89	0.721
adium	MG/KG	12	12	100%	0.5	44	14.475	11.336
	MG/KG	12	12	100%	178	42600	8965.25	14827.96
RBICIDES								
5-T	UG/KG	8	2	25%	3.9	13	8.45	6.435
5-TP (Silvex)	UG/KG	8	1	13%	7.9	7.9	7.9	0
D	UG/KG	8	1	13%	160	160	160	0
DB	UG/KG	8	1	13%	130	130	130	0
apon	UG/KG	8	0	0%				
amba	UG/KG	8	0	0%				
hloroprop	UG/KG	8	1	13%	61	61	61	0
oseb	UG/KG	8	0	0%				
PA	UG/KG	8	1	13%	6000	6000	6000	0
PP	UG/KG	8	1	13%	22000	22000	22000	0

Table 4-2
SEAD-16 Summary of Analytes Detected in Building Materials

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	BS-10		BS-11		FS-50		FS-50		FS16-1		FS16-2		FS16-3	
			SAMP ID:	16024		16022		16023		16028		FS16-1-1		FS16-2-1		FS16-3-1	
			QC CODE:	SA		SA		SA		DU		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		ESI		ESI		ESI	
			BUILDING NO.:	366		366		366		366		311		311		311	
			MATRIX:	SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS	
			SAMPLE DATE:	8/8/96		8/8/96		8/8/96		8/8/96		12/6/93		12/6/93		12/6/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
VOLATILE ORGANICS																	
1,1,1-Trichloroethane	800	NYSDEC TAGM	UG/KG	7	J			25	U	22	U	11	U	10	U	11	U
Bromomethane			UG/KG	53	UJ			25	UJ	22	J	11	U	10	U	11	U
Chloroform	300	NYSDEC TAGM	UG/KG	53	U			25	U	14	J	11	U	10	U	11	U
Chloromethane			UG/KG	53	UJ			25	UJ	22	J	11	U	10	U	11	U
Methylene Chloride	100	NYSDEC TAGM	UG/KG	7	J			25	U	22	U	11	U	10	U	11	U
Toluene	1500	NYSDEC TAGM	UG/KG	20	J			25	UJ	22	U	11	U	10	U	11	U
Trichloroethene	700	NYSDEC TAGM	UG/KG	13	J			25	U	22	U	11	U	10	U	11	U
SEMIVOLATILE ORGANICS																	
2,4-Dinitrotoluene			UG/KG	3000000	J			200	J	720	UJ	360	U	340	U	5700	U
2,6-Dinitrotoluene	1000	NYSDEC TAGM	UG/KG	**74000**	**J**			800	U	720	U	360	U	340	U	5700	U
2-Methylnaphthalene	36400	NYSDEC TAGM	UG/KG	500000	U			800	U	720	U	25	J	21	J	19000	
Acenaphthene	50000	NYSDEC TAGM	UG/KG	500000	U			800	U	720	U	23	J	340	U	4500	J
Anthracene	50000	NYSDEC TAGM	UG/KG	500000	U			800	U	720	U	22	J	340	U	2900	J
Benzo(a)anthracene	224	NYSDEC TAGM	UG/KG	500000	U			800	U	720	U	81	J	40	J	**1000**	**J**
Benzo(a)pyrene	61	NYSDEC TAGM	UG/KG	500000	U			43	J	42	J	**70**	**J**	45	J	**770**	**J**
Benzo(b)fluoranthene	1100	NYSDEC TAGM	UG/KG	500000	U			120	J	110	J	91	J	130	J	500	J
Benzo(g,h,i)perylene	50000	NYSDEC TAGM	UG/KG	500000	U			74	J	720	UJ	360	U	120	J	870	J
Benzo(k)fluoranthene	1100	NYSDEC TAGM	UG/KG	500000	U			800	UJ	720	UJ	73	J	77	J	630	J
Butylbenzylphthalate	50000	NYSDEC TAGM	UG/KG	**54000**	**J**			55	J	720	U	360	U	340	U	5700	U
Carbazole			UG/KG	500000	U			800	U	720	U	24	J	340	U	5700	U
Chrysene	400	NYSDEC TAGM	UG/KG	500000	U			96	J	73	J	110	J	150	J	**1400**	**J**
Di-n-butylphthalate	8100	NYSDEC TAGM	UG/KG	**950000**				190	J	210	J	360	U	340	U	5700	U
Dibenz(a,h)anthracene	14	NYSDEC TAGM	UG/KG	500000	U			800	UJ	720	UJ	360	U	**26**	**J**	**500**	**J**
Dibenzofuran	6200	NYSDEC TAGM	UG/KG	500000	U			800	U	720	U	360	U	46	J	1500	J

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-2
SEAD-16 Summary of Analytes Detected in Building Materials

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	BS-10		BS-11		FS-50		FS-50		FS16-1		FS16-2		FS16-3	
			SAMP ID:	16024		16022		16023		16028		FS16-1-1		FS16-2-1		FS16-3-1	
			QC CODE:	SA		SA		SA		DU		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		ESI		ESI		ESI	
			BUILDING NO.:	366		366		366		366		311		311		311	
			MATRIX:	SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS	
			SAMPLE DATE:	8/8/96		8/8/96		8/8/96		8/8/96		12/6/93		12/6/93		12/6/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Diethylphthalate	7100	NYSDEC TAGM	UG/KG	500000	U			800	U	720	U	360	U	340	U	530	J
Fluoranthene	50000	NYSDEC TAGM	UG/KG	500000	U			110	J	99	J	160	J	920		3100	J
Fluorene	50000	NYSDEC TAGM	UG/KG	500000	U			800	U	720	U	25	J	340	U	6100	
Indeno(1,2,3-cd)pyrene	3200	NYSDEC TAGM	UG/KG	500000	U			51	J	720	UJ	360	U	92	J	450	J
N-Nitrosodiphenylamine (1)			UG/KG	200000	J			800	U	720	U	360	U	340	U	5700	U
Naphthalene	13000	NYSDEC TAGM	UG/KG	500000	U			800	U	720	U	360	U	43	J	1600	J
Pentachlorophenol	1000	NYSDEC TAGM	UG/KG	1200000	U			220	J	1700	U	880	U	830	U	14000	U
Phenanthrene	50000	NYSDEC TAGM	UG/KG	500000	U			64	J	720	U	130	J	550		22000	
Phenol	30	NYSDEC TAGM	UG/KG	500000	U			800	U	720	U	**81**	**J**	340	U	**37000**	
Pyrene	50000	NYSDEC TAGM	UG/KG	500000	U			95	J	130	J	200	J	570		5000	J
bis(2-Ethylhexyl)phthalate	50000	NYSDEC TAGM	UG/KG	500000	U			800	U	800	U	360	U	340	U	5700	U
PESTICIDES/PCB																	
4,4'-DDD	2900	NYSDEC TAGM	UG/KG	1000	U			8	U	7.2	U	5.2	J	3.1	J	9.2	U
4,4'-DDE	2100	NYSDEC TAGM	UG/KG	1000	U			6.3	J	7.3	J	13	J	17	J	73	J
4,4'-DDT	2100	NYSDEC TAGM	UG/KG	940	J			53		61		8.1	J	6.1	J	61	J
Aroclor-1254	10000	NYSDEC TAGM	UG/KG	10000	U			100	J	120		36	J	56		130	
Aroclor-1260	10000	NYSDEC TAGM	UG/KG	10000	U			45	J	61	J	37		51		97	
Dieldrin	44	NYSDEC TAGM	UG/KG	1000	U			8	U	7.2	U	4.2	J	3.4	U	9.2	U
Endosulfan I	900	NYSDEC TAGM	UG/KG	540	U			3.3	J	3.7	U	1.9	U	1.8	U	4.7	U
Endosulfan II	900	NYSDEC TAGM	UG/KG	1000	U			8	U	7.2	U	3.6	U	3.4	J	5.7	J
Endrin	100	NYSDEC TAGM	UG/KG	1000	U			8	U	7.2	U	3.6	U	3.4	U	9.2	J
Heptachlor epoxide	20	NYSDEC TAGM	UG/KG	540	U			4.1	U	3.7	U	1.9	U	1.8	U	2.6	J
alpha-BHC	110	NYSDEC TAGM	UG/KG	540	U			3.7	J	2	J	1.9	U	1.8	U	4.7	U
alpha-Chlordane			UG/KG	540	U			3.8	J	3.7	J	1.2	J	2.1	J	3.8	J
gamma-BHC (Lindane)	60	NYSDEC TAGM	UG/KG	540	U			4.1	U	3.7	U	0.93	J	1.8	U	4.7	U

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-2
SEAD-16 Summary of Analytes Detected in Building Materials

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	BS-10		BS-11		FS-50		FS-50		FS16-1		FS16-2		FS16-3	
			SAMP ID:	1602-.		16022		16023		16028		FS16-1-1		FS16-2-1		FS16-3-1	
			QC CODE:	SA		SA		SA		DU		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		ESI		ESI		ESI	
			BUILDING NO.:	366		366		366		366		311		311		311	
			MATRIX:	SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS	
			SAMPLE DATE:	8/8/96		8/8/96		8/8/96		8/8/96		12/6/93		12/6/93		12/6/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
gamma-Chlordane	540	NYSDEC TAGM	UG/KG	540	U			2.3	J	2.3	J	1.9	U	2.1	J	4.6	J
OTHER ANALYSES																	
Nitrate/Nitrite-Nitrogen			MG/KG	14200				539		638		151		13.7		0.21	
Percent Moisture (PEST/PCB)				8				59		54							
Percent Moisture (SVOCs)				8				58		54							
Percent Moisture (VOCs)				6				60		54							
Percent Solids (Metals)				91.5		72.5		41.2		45.8							
NITROAROMATICS																	
1,3,5-Trinitrobenzene			UG/KG	120000	U	620000	U	1200	U	220	J	130	U	130	UJ	130	U
2,4,6-Trinitrotoluene			UG/KG	120000	U	620000	U	1200	U	120	U	170	J	130	UJ	130	U
2,4-Dinitrotoluene			UG/KG	3700000		19000000		36000		4600	J	130	U	72	J	130	U
METALS																	
Aluminum	14592.8	NYSDEC TAGM	MG/KG	13600	R	1380	R	4590	R	9580	R	9540		**16500**		6610	
Antimony	3.59	NYSDEC TAGM	MG/KG	**32.5**	**J**	**82.4**	**J**	**322**	**J**	**1050**	**J**	4.6	U	**1250**		**1560**	
Arsenic	7.5	NYSDEC TAGM	MG/KG	**9.1**	**J**	1.3	J	6.7	J	**13.6**	**J**	3.4		**47.3**		**26.9**	
Barium	300	NYSDEC TAGM	MG/KG	**40500**	**J**	**3520**	**J**	225	J	**381**	**J**	145		**15600**		**6950**	
Beryllium	0.16	NYSDEC TAGM	MG/KG	**0.16**		0.04	U	**0.28**		**0.72**		**0.51**	**J**	0.09	J	0.08	U
Cadmium	1	NYSDEC TAGM	MG/KG	**54.6**		0.41		0.94		**1.5**		22.2	R	36.8	R	156	R
Calcium	101904	NYSDEC TAGM	MG/KG	5390		586		85900		**107000**		19800		13800		21200	
Chromium	10	NYSDEC TAGM	MG/KG	**518**		4.3		**36.7**		**60.7**		**15.8**		**220**		**33.2**	
Cobalt	30	NYSDEC TAGM	MG/KG	26.3		2.7		6.8		10.9		15		20.9		9.7	J
Copper	25	NYSDEC TAGM	MG/KG	**16200**		**5260**		**99.1**		**130**		**211**	**J**	**38900**	**J**	**81400**	**J**
Cyanide	0.3	NYSDEC TAGM	MG/KG	**24.2**	**J**	**9.7**	**J**	1	UJ	1	UJ	**1.1**		**1.4**		0.74	U
Iron	2000	NYSDEC TAGM	MG/KG	**79200**	**J**	**2690**	**J**	**59200**	**J**	**79700**	**J**	**19700**		**49300**		**30500**	
Lead	21.86	NYSDEC TAGM	MG/KG	**4180**		**132**		**391**		**420**		**810**		**437000**		**527000**	

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-2
SEAD-16 Summary of Analytes Detected in Building Materials

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	BS-10		BS-11		FS-50		FS-50		FS16-1		FS16-2		FS16-3	
			SAMP ID:	16024		16022		16023		16028		FS16-1-1		FS16-2-1		FS16-3-1	
			QC CODE:	SA		SA		SA		DU		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		ESI		ESI		ESI	
			BUILDING NO.:	366		366		366		366		311		311		311	
			MATRIX:	SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS	
			SAMPLE DATE:	8/8/96		8/8/96		8/8/96		8/8/96		12/6/93		12/6/93		12/6/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Magnesium	12221.8	NYSDEC TAGM	MG/KG	8450		3370		8500		**15300**		4850		**16400**		**19700**	
Manganese	669.38	NYSDEC TAGM	MG/KG	507		27.3		574		**1040**		488	J	334	J	214	J
Mercury	0.1	NYSDEC TAGM	MG/KG	**24.9**		0.07	U	0.12	U	**0.11**		**0.81**		**39.3**		**1.8**	
Nickel	13	NYSDEC TAGM	MG/KG	**154**		2.1		**20.9**		**60.1**		**21.1**		**119**		**66.8**	
Potassium	1761.48	NYSDEC TAGM	MG/KG	**80600**		**2830**		**3770**		**4980**		**10500**		1570		636	J
Selenium	2	NYSDEC TAGM	MG/KG	1.6		0.95		1.3		**2.1**		**5.8**	**J**	1.3	UJ	1.6	UJ
Silver	0.4	NYSDEC TAGM	MG/KG	**3.6**		**0.62**		0.29	U	0.46	U	0.9	U	**13.4**		**22.7**	
Sodium	103.74	NYSDEC TAGM	MG/KG	**3090**	**J**	63.1	J	**3460**	**J**	**4440**	**J**	**3690**		**2650**		**152**	**J**
Thallium	0.28	NYSDEC TAGM	MG/KG	0.84	U	0.57	U	1	U	1.6	U	**0.38**	**J**	2.2	UJ	**1.4**	**J**
Vanadium	150	NYSDEC TAGM	MG/KG	20.4	J	0.5		5.6		12.2		17.7		12.9		6.2	J
Zinc	20	NYSDEC TAGM	MG/KG	**42600**		**1640**		**334**		**495**		**715**	**J**	**12400**	**J**	**35700**	**J**
HERBICIDES																	
2,4,5-T	1900	NYSDEC TAGM	UG/KG									3.9	J	5.2	U	6.9	U
2,4,5-TP (Silvex)			UG/KG									7.9	J	5.2	U	6.9	U
2,4-D	500	NYSDEC TAGM	UG/KG									55	U	52	U	69	U
2,4-DB			UG/KG									130	J	52	U	69	U
Dichloroprop			UG/KG									61	J	52	U	69	U
MCPA			UG/KG									6000	J	5200	U	6900	U
MCPP			UG/KG									22000	J	5200	U	6900	U

Note: Shaded values exceed the NYSDEC TAGM.
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Table 4-2
SEAD-16 Summary of Analytes Detected in Building Materials

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	FS16-4		FS16-5		FS16-6		FS16-7		FS16-8	
			SAMP ID:	FS16-4-1		FS16-5-1		FS16-6-1		FS16-7-1		FS16-8-1	
			QC CODE:	SA		SA		SA		SA		SA	
			STUDY ID:	ESI		ESI		ESI		ESI		ESI	
			BUILDING NO.:	311		311		311		311		311	
			MATRIX:	SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS	
			SAMPLE DATE:	12/6/93		12/6/93		12/6/93		12/6/93		12/6/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
VOLATILE ORGANICS													
1,1,1-Trichloroethane	800	NYSDEC TAGM	UG/K	18	U	11	U	11	U	25	UJ	21	UJ
Bromomethane			UG/KG	18	U	11	U	11	U	25	UJ	21	UJ
Chloroform	300	NYSDEC TAGM	UG/KG	18	U	11	U	11	U	25	UJ	21	UJ
Chloromethane			UG/KG	18	U	11	U	11	U	25	UJ	21	UJ
Methylene Chloride	100	NYSDEC TAGM	UG/KG	18	U	11	U	11	U	25	UJ	21	UJ
Toluene	1500	NYSDEC TAGM	UG/KG	18	U	11	U	11	U	25	UJ	21	UJ
Trichloroethene	700	NYSDEC TAGM	UG/KG	18	U	11	U	11	U	25	UJ	21	UJ
SEMIVOLATILE ORGANICS													
2,4-Dinitrotoluene			UG/KG	620	U	380	U	2700		2600	UJ	5100	UJ
2,6-Dinitrotoluene	1000	NYSDEC TAGM	UG/KG	620	U	380	U	200	J	2600	UJ	5100	UJ
2-Methylnaphthalene	36400	NYSDEC TAGM	UG/KG	49	J	40	J	360	U	180	J	5100	UJ
Acenaphthene	50000	NYSDEC TAGM	UG/KG	620	U	380	U	360	U	560	J	5100	UJ
Anthracene	50000	NYSDEC TAGM	UG/KG	620	U	22	J	360	U	670	J	5100	UJ
Benzo(a)anthracene	224	NYSDEC TAGM	UG/KG	44	J	54	J	92	J	**1600**	**J**	**330**	**J**
Benzo(a)pyrene	61	NYSDEC TAGM	UG/KG	**61**	**J**	54	J	**90**	**J**	**1500**	**J**	**400**	**J**
Benzo(b)fluoranthene	1100	NYSDEC TAGM	UG/KG	73	J	47	J	99	J	**1600**	**J**	750	J
Benzo(g,h,i)perylene	50000	NYSDEC TAGM	UG/KG	620	U	380	U	61	J	360	J	5100	UJ
Benzo(k)fluoranthene	1100	NYSDEC TAGM	UG/KG	60	J	50	J	92	J	**1600**	**J**	630	J
Butylbenzylphthalate	50000	NYSDEC TAGM	UG/KG	620	U	380	U	360	UR	2600	UJ	5100	UJ
Carbazole			UG/KG	620	U	36	J	21	J	740	J	5100	UJ
Chrysene	400	NYSDEC TAGM	UG/KG	74	J	120	J	110	J	**1900**	**J**	**680**	**J**
Di-n-butylphthalate	8100	NYSDEC TAGM	UG/KG	620	U	50	J	710	UJ	2600	UJ	5100	UJ
Dibenz(a,h)anthracene	14	NYSDEC TAGM	UG/KG	620	U	380	U	360	U	2600	UJ	5100	UJ
Dibenzofuran	6200	NYSDEC TAGM	UG/KG	620	U	22	J	360	U	390	J	5100	UJ

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-2
SEAD-16 Summary of Analytes Detected in Building Materials

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	FS16-4		FS16-5		FS16-6		FS16-7		FS16-8	
			SAMP ID:	FS16-4-1		FS16-5-1		FS16-6-1		FS16-7-1		FS16-8-1	
			QC CODE:	SA		SA		SA		SA		SA	
			STUDY ID:	ESI		ESI		ESI		ESI		ESI	
			BUILDING NO.:	311		311		311		311		311	
			MATRIX:	SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS	
			SAMPLE DATE:	12/6/93		12/6/93		12/6/93		12/6/93		12/6/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Diethylphthalate	7100	NYSDEC TAGM	UG/KG	620	U	380	U	360	U	2600	UJ	5100	UJ
Fluoranthene	50000	NYSDEC TAGM	UG/KG	140	J	120	J	210	J	3900	J	630	J
Fluorene	50000	NYSDEC TAGM	UG/KG	620	U	380	U	360	U	560	J	5100	UJ
Indeno(1,2,3-cd)pyrene	3200	NYSDEC TAGM	UG/KG	620	U	380	U	39	J	400	J	5100	UJ
N-Nitrosodiphenylamine (1)			UG/KG	620	U	380	U	450		2600	UJ	5100	UJ
Naphthalene	13000	NYSDEC TAGM	UG/K	620	U	19	J	360	U	410	J	5100	UJ
Pentachlorophenol	1000	NYSDEC TAGM	UG/KG	1500	U	920	U	870	U	6300	UJ	12000	UJ
Phenanthrene	50000	NYSDEC TAGM	UG/KG	120	J	100	J	110	J	4100	J	360	J
Phenol	30	NYSDEC TAGM	UG/KG	**150**	**J**	380	U	360	U	2600	UJ	5100	UJ
Pyrene	50000	NYSDEC TAGM	UG/KG	120	J	130	J	160	J	3200	J	720	J
bis(2-Ethylhexyl)phthalate	50000	NYSDEC TAGM	UG/KG	440	J	5000	J	52	J	500	J	1300	J
PESTICIDES/PCB													
4,4'-DDD	2900	NYSDEC TAGM	UG/KG	12	U	35	J	3.6	U	39	UJ	76	UJ
4,4'-DDE	2100	NYSDEC TAGM	UG/KG	17		750		6.3	J	97	J	180	J
4,4'-DDT	2100	NYSDEC TAGM	UG/KG	140		610		7.2		360	J	870	J
Aroclor-1254	10000	NYSDEC TAGM	UG/KG	120	U	75	U	36	U	360	J	1400	J
Aroclor-1260	10000	NYSDEC TAGM	UG/KG	120	U	89		36	U	390	UJ	630	J
Dieldrin	44	NYSDEC TAGM	UG/KG	12	U	7.5	U	3.6	U	28	J	76	UJ
Endosulfan I	900	NYSDEC TAGM	UG/KG	6.4	U	3.9	U	1.8	U	22	J	39	UJ
Endosulfan II	900	NYSDEC TAGM	UG/KG	12	U	3.9	J	3.6	U	39	UJ	76	UJ
Endrin	100	NYSDEC TAGM	UG/KG	12	U	7.5	U	3.6	U	39	UJ	76	UJ
Heptachlor epoxide	20	NYSDEC TAGM	UG/KG	6.4	U	3.9	U	1.8	U	20	UJ	39	UJ
alpha-BHC	110	NYSDEC TAGM	UG/KG	6.4	U	3.9	U	1.8	U	20	UJ	39	UJ
alpha-Chlordane			UG/KG	6.4	U	3.1	J	1.8	U	13	J	47	J
gamma-BHC (Lindane)	60	NYSDEC TAGM	UG/KG	6.4	U	3.9	U	1.8	U	20	UJ	39	UJ

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-2
SEAD-16 Summary of Analytes Detected in Building Materials

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	FS16-4		FS16-5		FS16-6		FS16-7		FS16-8	
			SAMP ID:	FS16-4-1		FS16-5-1		FS16-6-1		FS16-7-1		FS16-8-1	
			QC CODE:	SA		SA		SA		SA		SA	
			STUDY ID:	ESI		ESI		ESI		ESI		ESI	
			BUILDING NO.:	311		311		311		311		311	
			MATRIX:	SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS	
			SAMPLE DATE:	12/6/93		12/6/93		12/6/93		12/6/93		12/6/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
gamma-Chlordane	540	NYSDEC TAGM	UG/KG	6.4	U	2.9	J	1.8	U	12	J	36	J
OTHER ANALYSES													
Nitrate/Nitrite-Nitrogen			MG/KG	0.27		2		104		0.89		0.05	
Percent Moisture (PEST/PCB)													
Percent Moisture (SVOCs)													
Percent Moisture (VOCs)													
Percent Solids (Metals)													
NITROAROMATICS													
1,3,5-Trinitrobenzene			UG/KG	130	U	130	U	130	U	130	UJ	130	UJ
2,4,6-Trinitrotoluene			UG/KG	130	U	130	U	130	U	130	UJ	130	UJ
2,4-Dinitrotoluene			UG/KG	2900		130	U	610		3100	J	610	J
METALS													
Aluminum	14592.8	NYSDEC TAGM	MG/KG	9550		2960		11300		7960	J	13700	J
Antimony	3.59	NYSDEC TAGM	MG/KG	**31.5**		**11.9**	**J**	**11.2**	**J**	**21.8**	**J**	**93.2**	**J**
Arsenic	7.5	NYSDEC TAGM	MG/KG	7.1		1.9		6.5		**8**	**J**	**15.9**	**J**
Barium	300	NYSDEC TAGM	MG/KG	**466**		88.2		289		**392**	**J**	**2110**	**J**
Beryllium	0.16	NYSDEC TAGM	MG/KG	**1.1**	**J**	**0.19**	**J**	**0.49**	**J**	**0.32**	**J**	**0.27**	**J**
Cadmium	1	NYSDEC TAGM	MG/KG	1	R	**3**		**1.2**		**72.8**	**J**	**127**	**J**
Calcium	101904	NYSDEC TAGM	MG/KG	23000		**215000**		41800		41600	J	67400	J
Chromium	10	NYSDEC TAGM	MG/KG	6.4		33.2	R	21.3	R	22.1	R	174	R
Cobalt	30	NYSDEC TAGM	MG/KG	3.3	J	5.6	J	9.9		6	J	**40.6**	**J**
Copper	25	NYSDEC TAGM	MG/KG	**129**	**J**	**90**	**J**	**198**	**J**	**593**	**J**	**757**	**J**
Cyanide	0.3	NYSDEC TAGM	MG/KG	1	U	0.61	U	0.58	U	**2.3**	**J**	**4.4**	**J**
Iron	2000	NYSDEC TAGM	MG/KG	**8420**		**41300**		**25000**		**17200**	**J**	**48600**	**J**
Lead	21.86	NYSDEC TAGM	MG/KG	**596**		**309**		**865**		**1560**	**J**	**12100**	**J**

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-2
SEAD-16 Summary of Analytes Detected in Building Materials

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	FS16-4		FS16-5		FS16-6		FS16-7		FS16-8	
			SAMP ID:	FS16-4-1		FS16-5-1		FS16-6-1		FS16-7-1		FS16-8-1	
			QC CODE:	SA		SA		SA		SA		SA	
			STUDY ID:	ESI		ESI		ESI		ESI		ESI	
			BUILDING NO.:	311		311		311		311		311	
			MATRIX:	SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS	
			SAMPLE DATE:	12/6/93		12/6/93		12/6/93		12/6/93		12/6/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Magnesium	12221.8	NYSDEC TAGM	MG/KG	2470		**15700**		**16400**		10500	J	**15700**	**J**
Manganese	669.38	NYSDEC TAGM	MG/KG	194	J	480		456		301	J	458	J
Mercury	0.1	NYSDEC TAGM	MG/KG	**0.34**		**0.1**		**1.2**		**2.4**	**J**	**3.7**	**J**
Nickel	13	NYSDEC TAGM	MG/KG	7.9	J	**18.8**		**30.5**		**21.5**	**J**	**124**	**J**
Potassium	1761.48	NYSDEC TAGM	MG/KG	1550	J	704	J	1480		1430	J	1360	J
Selenium	2	NYSDEC TAGM	MG/KG	0.26	UJ	0.13	UJ	0.72	J	1.6	J	0.91	J
Silver	0.4	NYSDEC TAGM	MG/KG	1.5	U	0.73	U	0.8	U	1.3	UJ	1.7	UJ
Sodium	103.74	NYSDEC TAGM	MG/KG	**365**	**J**	**179**	**J**	**200**	**J**	97.9	J	**302**	**J**
Thallium	0.28	NYSDEC TAGM	MG/KG	0.44	UJ	0.22	U	0.25	U	0.45	UJ	0.39	UJ
Vanadium	150	NYSDEC TAGM	MG/KG	7	J	8.3	J	18.3		20.6	J	44	J
Zinc	20	NYSDEC TAGM	MG/KG	**178**	**J**	**318**		**293**		**1310**	**J**	**11600**	**J**
HERBICIDES													
2,4,5-T	1900	NYSDEC TAGM	UG/KG	9.4	U	5.8	U	5.5	U	12	UJ	13	J
2,4,5-TP (Silvex)			UG/KG	9.4	U	5.8	U	5.5	U	12	UJ	12	UJ
2,4-D	500	NYSDEC TAGM	UG/KG	94	U	58	U	55	U	120	UJ	160	J
2,4-DB			UG/KG	94	U	58	U	55	U	120	UJ	120	UJ
Dichloroprop			UG/KG	94	U	58	U	55	U	120	UJ	120	UJ
MCPA			UG/KG	9400	U	5800	U	5500	U	12000	UJ	12000	UJ
MCPP			UG/KG	9400	U	5800	U	5500	U	12000	UJ	12000	UJ

Note: Shaded values exceed the NYSDEC TAGM.

4.1.2.5 Herbicides

Seven herbicides were detected in two of the eight building samples collected during the ESI field program (Table 4-2). Samples collected during the RI field investigation were not submitted for the chemical analyses of herbicides. None of the compounds were detected at concentrations above their respective TAGM values. The two samples were, FS16-1 and FS16-8, which were collected from the floor of Building S-311.

No herbicides were detected in the standing water samples collected from Building S-311.

4.1.2.6 Metals

Twenty-four metals were detected in the building materials collected from the two buildings at SEAD-16 (Table 4-2). Twenty-three of these metals were detected at concentrations above their respective TAGM values. Of the 23 metals, the following 15 are considered to be more toxic and will be discussed below: antimony, arsenic, barium, cadmium, chromium, cobalt, copper, cyanide, lead, mercury, nickel, selenium, silver, thallium, and zinc.

Antimony was detected in 12 building material samples at concentrations above the NYSDEC TAGM value of 3.59 mg/kg. Its maximum concentration of 1560 mg/kg was detected in FS16-3, which is a floor sample from Building S-311. Six samples contained arsenic at concentrations above the TAGM value with the maximum concentration of 47.3 mg/kg found in FS16-2. Sample FS16-2 is a floor sample from Building S-311. Barium was detected in eight samples at concentrations exceeding the TAGM value and its maximum concentration of 40,500 mg/kg was found in BS-10, which is a propellant sample from Building 366. Six samples contained cadmium at concentrations exceeding the TAGM value. Cadmium's maximum concentration of 127 J mg/kg was found in FS16-8, which is a floor sample from Building S-311. Chromium was detected in six building samples at concentrations above the TAGM value with the maximum concentration of 518 mg/kg found in BS-10. Cobalt was detected in only one sample above the TAGM value. Copper was detected in all 12 samples at concentrations above the NYSDEC TAGM of 0.3 mg/kg and its maximum concentration of 81,400 J mg/kg was found in FS-16-3. Cyanide was detected in six samples above the TAGM value. The maximum cyanide concentration of 24.2 J mg/kg was found in BS-10. Lead was found in all 12 samples at concentrations above the NYSDEC TAGM value. The two maximum concentrations of lead, 527,000 mg/kg and 437,000 mg/kg, were detected in BS-10 and FS16-2, respectively. Mercury was detected in ten samples at concentrations above the TAGM value of 0.1 mg/kg. The maximum concentration of 39.3 mg/kg was detected in FS16-2. Nickel was detected in 10 samples above the TAGM value with the maximum concentration found in BS-10. Selenium was detected in two samples above the TAGM value. Silver was detected in four samples at concentrations above the TAGM value of 0.4 mg/kg

with the maximum concentration of 22.7 mg/kg found in FS16-3. Thallium was detected in only two samples at concentrations above the TAGM value. Zinc was detected in all 12 samples at concentrations above the NYSDEC TAGM value of 20 mg/kg. Zinc's two maximum concentrations, 42,600 mg/kg and 35,700 mg/kg, were found in BS-10 and FS16-3, respectively.

Aluminum, barium, calcium, and copper were detected in the standing water samples, and copper was the only metal found at concentrations above the NYS Class C surface water criteria.

4.1.2.7 Other Constituents

Asbestos

Asbestos samples were collected from within Buildings S-311 and 366 at 43 locations with duplicate and triplicate samples collected at 12 locations. The total number of asbestos samples is 61. Summary statistics for the asbestos samples are presented in Table 4-3.

Asbestos was detected in samples collected from 13 locations with eleven of the samples collected from Building S-311 (Table 4-4). Samples AS16-1 and AS16-3 consisted of pipe insulation from Rooms 6 and 4, respectively. Samples AS16-5 and AS16-6 were samples of transite from the hallway. Sample AS16-7 was a roofing debris sample collected from the loading platform. Samples AS16-17 and AS16-18 were roofing material samples collected from Rooms 6 and 1, respectively. Samples AS16-27, AS16-28, AS16-29, AS16-30 were collected from Room 4; AS16-27 and AS16-28 were collected from a cardboard box and AS16-29 and AS16-30 were floor tile samples. The location of these samples is shown in Figure 2-2.

Two of the samples with detections of asbestos were collected from Building 366. Samples AS16-40 and AS16-42 were pipe samples collected from the walkway. Refer to Figure 2-5 for the location of these samples from Building 366.

4.1.3 Indoor Air

Indoor air samples were collected from inside Building S-311 and from a background location outside the building. Threshold Limit Value-Time-Weighted Average (TLV-TWA) concentrations, published by the American Conference of Governmental Industrial Hygienists (ACHIH), were determined to be the most appropriate basis of comparison for the air sampling results. Table 4-5 presents indoor air data.

Table 4-3
Summary Statistics for Building Materials

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
ANALYSES								
Amosite Asbestos	%	14	0	0%				
Amosite Asbestos	%, +-5	2	2	100%	40	50	45	7.071
Chrysotile Asbestos	%	54	5	9%	35	65	50	11.18
Chrysotile Asbestos	%, > TH	5	5	100%	1	1	1	0
Chrysotile Asbestos	%, +-2.	2	2	100%	7.5	12.5	10	3.536
Chrysotile Asbestos	%, +-5	3	3	100%	20	30	26.667	5.774
Nitrate/Nitrite-Nitrogen	MG/KG	11	11	100%	0.05	14200	1422.647	4243.916
Percent Moisture (PEST/PCB)		3	3	100%	8	59	40.333	28.113
Percent Moisture (SVOCs)		3	3	100%	8	58	40	27.785
Percent Moisture (VOCs)		3	3	100%	6	60	40	29.597
Percent Solids (Metals)		4	4	100%	41.2	91.5	62.75	23.617

Table 4-4
SEAD-16 Summary of Analytes Detected in Asbestos

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

	LOC_ID:	AS16-1		AS16-10		AS16-11		AS16-12		AS16-13		AS16-14		AS16-15		AS16-16		AS16-17		AS16-17	
	SAMP ID:	AS16-1		AS16-10		AS16-11		AS16-12		AS16-13		AS16-14		AS16-15		AS16-16		AS16-17A		AS16-17B	
	QC CODE:	SA		SA		SA		SA		SA		SA		SA		SA		SA		SA	
	STUDY ID:	ESI		ESI		ESI		ESI		ESI		ESI		ESI		ESI		RI ROUND1		RI ROUND1	
	BUILDING:	311		311		311		311		311		311		311		311		311		311	
	MATRIX:	SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS	
	SAMPLE DATE:	12/6/93		12/6/93		12/6/93		12/6/93		12/6/93		12/6/93		12/6/93		12/6/93		8/8/96 8:00		8/8/96 8:00	
PARAMETER	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
OTHER ANALYSES																					
Amosite Asbestos	%, +-5%	40		1	U	1	U	1	U	1	U	1	U	1	U	1	U				
Chrysotile Asbestos	%	20		0.5	U	1	U	1	U	1	U	1	U	1	U	1	U	1		0	U

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SEAD-16 Summary of Analytes Detected in Asbestos

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

	LOC_ID:	AS16-17		AS16-18		AS16-18		AS16-18		AS16-18		AS16-19		AS16-19		AS16-2		AS16-20
	SAMP ID:	AS16-17C		AS16-18A		AS16-18B		AS16-46A		AS16-46B		AS16-19A		AS16-19B		AS16-2		AS16-20
	QC CODE:	SA		SA		SA		DU		DU		SA		SA		SA		SA
	STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		ESI		RI ROUND1
	BUILDING:	311		311		311		311		311		311		311		311		311
	MATRIX:	SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS
	SAMPLE DATE:	8/8/96 8:00		8/8/96 8:00		8/8/96 8:00		8/8/96 8:00		8/8/96 8:00		8/8/96 8:00		8/8/96 8:00		12/6/93		8/8/96 8:00
PARAMETER	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE
OTHER ANALYSES																		
Amosite Asbestos	%, +-5%															1	U	
Chrysotile Asbestos	%	0	U	1		0	U	1		0	U	0	U	0	U	1	U	0

Table 4-4
SEAD-16 Summary of Analytes Detected in Asbestos

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

	LOC_ID:		AS16-21		AS16-21		AS16-22		AS16-23		AS16-24		AS16-24		AS16-25		AS16-26	
	SAMP ID:		AS16-21A		AS16-21B		AS16-22		AS16-23		AS16-24		AS16-45		AS16-25		AS16-26	
	QC CODE:		SA		SA		SA		SA		SA		DU		SA		SA	
	STUDY ID:		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
	BUILDING:		311		311		311		311		311		311		311		366	
	MATRIX:		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS	
	SAMPLE DATE:		8/8/96 8:00		8/8/96 8:00		8/8/96 8:00		8/8/96 8:00		8/8/96 8:00		8/8/96 8:00		8/8/96 8:00		8/8/96 8:00	
PARAMETER	UNIT	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
OTHER ANALYSES																		
Amosite Asbestos	%, +-5%																	
Chrysotile Asbestos	%	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U

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SEAD-16 Summary of Analytes Detected in Asbestos

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

	LOC_ID:	AS16-27		AS16-28		AS16-29		AS16-29		AS16-29		AS16-3		AS16-30		AS16-30		AS16-30
	SAMP ID:	AS16-27		AS16-28		AS16-29A		AS16-29B		AS16-29C		AS16-3		AS16-30A		AS16-30B		AS16-30C
	QC CODE:	SA		SA		SA		SA		SA		SA		SA		SA		SA
	STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		ESI		RI ROUND1		RI ROUND1		RI ROUND1
	BUILDING:	311		311		311		311		311		311		311		311		311
	MATRIX:	SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS
	SAMPLE DATE:	8/8/96 8:00		8/8/96 8:00		8/8/96 8:00		8/8/96 8:00		8/8/96 8:00		12/6/93		8/8/96 8:00		8/8/96 8:00		8/8/96 8:00
PARAMETER	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE
OTHER ANALYSES																		
Amosite Asbestos	%, +-5%											50						
Chrysotile Asbestos	%	45		50		1		0	U	0	U	12.5		1		0	U	0

Table 4-4
SEAD-16 Summary of Analytes Detected in Asbestos

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

	LOC_ID:		AS16-31		AS16-32		AS16-33		AS16-34		AS16-35		AS16-36		AS16-37		AS16-37	
	SAMP ID:		AS16-31		AS16-32		AS16-33		AS16-34		AS16-35		AS16-36		AS16-37A		AS16-37B	
	QC CODE:		SA		SA		SA		SA		SA		SA		SA		SA	
	STUDY ID:		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
	BUILDING:		311		311		311		311		311		311		311		366	
	MATRIX:		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS	
	SAMPLE DATE:		8/8/96 8:00		8/8/96 8:00		8/8/96 8:00		8/8/96 8:00		8/8/96 8:00		8/8/96 8:00		8/8/96 8:00		8/8/96 8:00	
PARAMETER	UNIT	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
OTHER ANALYSES																		
Amosite Asbestos	%, +-5%																	
Chrysotile Asbestos	%	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U	0	U

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SEAD-16 Summary of Analytes Detected in Asbestos

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

	LOC_ID:	AS16-38		AS16-39		AS16-39		AS16-4		AS16-40		AS16-40		AS16-41		AS16-41		AS16-42
	SAMP ID:	AS16-38		AS16-39A		AS16-39B		AS16-4		AS16-40		AS16-44		AS16-41A		AS16-41B		AS16-42
	QC CODE:	SA		SA		SA		SA		SA		DU		SA		SA		SA
	STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		ESI		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1
	BUILDING:	366		366		366		311		366		366		366		366		366
	MATRIX:	SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS
	SAMPLE DATE:	8/8/96 8:00		8/8/96 8:00		8/8/96 8:00		12/6/93		8/8/96 8:00		8/8/96 8:00		8/8/96 8:00		8/8/96 8:00		8/8/96 8:00
PARAMETER	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE
OTHER ANALYSES																		
Amosite Asbestos	%, +-5%							1	U									
Chrysotile Asbestos	%	0	U	0	U	0	U	1	U	55		35		0	U	0	U	65

Table 4-4
SEAD-16 Summary of Analytes Detected in Asbestos

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

	LOC_ID:		AS16-43		AS16-43		AS16-43		AS16-5		AS16-6		AS16-7		AS16-8		AS16-9	
	SAMP ID:		AS16-43A		AS16-43B		AS16-43C		AS16-5		AS16-6		AS16-7		AS16-8		AS16-9	
	QC CODE:		SA		SA		SA		SA		DU		SA		SA		SA	
	STUDY ID:		RI ROUND1		RI ROUND1		RI ROUND1		ESI		ESI		ESI		ESI		ESI	
	BUILDING:		366		366		366		311		311		311		311		311	
	MATRIX:		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS		SOLIDS	
	SAMPLE DATE:		8/8/96 8:00		8/8/96 8:00		8/8/96 8:00		12/6/93		12/6/93		12/6/93		12/6/93		12/6/93	
PARAMETER	UNIT	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
OTHER ANALYSES																		
Amosite Asbestos	%, +-5%								1	U	1	U	1	U	1	U	1	U
Chrysotile Asbestos	%		0	U	0	U	0	U	30		30		7.5		1	U	1	U

Table 4-5

SEAD-16 Summary of Analytes Detected in Indoor Air

SEAD-16 Remedial Investigation

Seneca Army Depot Activity

			LOC_ID:	S-311BKGRD		S-311SWR4		S-311NER1		S-311NER1	
			SAMP ID:	16001/16006		16002/16007		16003/16008		16004/16009	
				16011/16016		16025/16026		16013/16018		16014/16019	
			QC CODE:	SA		SA		SA		DU	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			MATRIX:	AIR		AIR		AIR		AIR	
			SAMPLE DATE:								
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
SEMIVOLATILE ORGANICS											
Phenol	19000	TLV-TWA	UG/M3	0.0784	UJ	0.0676	J	0.0801	UJ	0.018	J
Benzoic acid	NA	TLV-TWA	UG/M3	0.1945	UJ	0.1413	J	0.1987	UJ	0.1862	UJ
Naphthalene	NA	TLV-TWA	UG/M3	0.0784	UJ	0.0584	J	0.0801	UJ	0.0751	UJ
2-Methylnaphthalene	NA	TLV-TWA	UG/M3	0.0784	UJ	0.0706	J	0.0417	J	0.051	J
Acenaphthene	NA	TLV-TWA	UG/M3	0.0784	UJ	0.0307	J	0.0801	UJ	0.021	J
Dibenzofuran	NA	TLV-TWA	UG/M3	0.0784	UJ	0.0307	J	0.0801	UJ	0.018	J
Diethylphthalate	5000	TLV-TWA	UG/M3	0.0784	UJ	0.0614	J	0.0256	J	0.042	J
Fluorene	NA	TLV-TWA	UG/M3	0.0784	UJ	0.0276	J	0.0801	UJ	0.0751	UJ
Phenanthrene	NA	TLV-TWA	UG/M3	0.0784	UJ	0.0491	J	0.0801	UJ	0.0751	UJ
Anthracene	NA	TLV-TWA	UG/M3	0.0784	UJ	0.0461	J	0.0801	UJ	0.0751	UJ
Di-n-butylphthalate	NA	TLV-TWA	UG/M3	0.0784	UJ	0.0276	J	0.0801	UJ	0.018	J
Butylbenzylphthalate	NA	TLV-TWA	UG/M3	0.0784	UJ	0.0276	J	0.0801	UJ	0.0751	UJ
bis(2-Ethylhexyl)phthalate	NA	TLV-TWA	UG/M3	0.0784	UJ	0.032	J	0.032	J	0.0871	J
METALS			UG/M3								
Aluminum	10000	TLV-TWA	UG/M3	0.1576		0.1256		0.1512		0.1392	
Antimony	500	TLV-TWA	UG/M3	0.0098	U	0.0098	U	0.0109	U	0.0104	U
Arsenic	200	TLV-TWA	UG/M3	0.0065	U	0.0066	U	0.0073	U	0.007	U
Barium	500	TLV-TWA	UG/M3	0.0144		0.0189		0.0195		0.0176	
Beryllium	2	TLV-TWA	UG/M3	0.0065	U	0.0066	U	0.0073	U	0.007	U
Cadmium	10	TLV-TWA	UG/M3	0.0065	U	0.0066	U	0.0073	U	0.007	U
Calcium	NA	TLV-TWA	UG/M3	0.6523	U	0.6553	U	0.7258	U	0.6962	U
Chromium	500	TLV-TWA	UG/M3	0.0196	U	0.0197	U	0.0218	U	0.0209	U

Table 4-5
SEAD-16 Summary of Analytes Detected in Indoor Air

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	S-311BKGRD		S-311SWR4		S-311NER1		S-311NER1	
			SAMP ID:	16001/16006		16002/16007		16003/16008		16004/16009	
				16011/16016		16025/16026		16013/16018		16014/16019	
			QC CODE:	SA		SA		SA		DU	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			MATRIX:	AIR		AIR		AIR		AIR	
			SAMPLE DATE:								
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Cobalt	50	TLV-TWA	UG/M3	0.0196	U	0.0197	U	0.0218	U	0.0209	U
Copper - dust	1000	TLV-TWA	UG/M3	0.3425		0.9829		1.5725		0.9862	
Iron	1000	TLV-TWA	UG/M3	0.3262	U	0.3276	U	0.3629	U	0.3481	U
Lead	150	TLV-TWA	UG/M3	0.0131		0.0364		0.0457		0.0363	
Magnesium	10000	TLV-TWA	UG/M3	0.1305	U	0.1311	U	0.1452	U	0.1392	U
Manganese	50000	TLV-TWA	UG/M3	0.0071		0.0048		0.0055		0.0045	
Mercury (solid)	NA	TLV-TWA	UG/M3	0.126		0.1251		0.1261		0.1264	
Mercury (gaseous)	50	TLV-TWA	UG/M3	0.3063		0.172		0.1709		0.1264	
Nickel	50	TLV-TWA	UG/M3	0.0261	U	0.0262	U	0.029	U	0.0278	U
Potassium	NA	TLV-TWA	UG/M3	0.6523	U	0.6553	U	0.7258	U	0.6962	U
Selenium	200	TLV-TWA	UG/M3	0.0046		0.0033	U	0.0052		0.0053	
Silver	100	TLV-TWA	UG/M3	0.0196	U	0.0197	U	0.0218	U	0.0209	U
Sodium	NA	TLV-TWA	UG/M3	1.3046	U	1.3105	U	1.4515	U	1.3923	U
Thallium	100	TLV-TWA	UG/M3	0.0065	U	0.0066	U	0.0073	U	0.007	U
Vanadium	50	TLV-TWA	UG/M3	0.0196	U	0.0197	U	0.0218	U	0.0209	U
Zinc	10000	TLV-TWA	UG/M3	0.0652	U	0.0655	U	0.0726	U	0.0696	U
ASBESTOS											
NIOSH 7400	.5 fiber/cc		fiber/ml	0.0011	U	0.0011	U	0.0011	U	0.0011	U

4.1.3.1 Semivolatile Organic Compounds

None of the indoor air samples contained SVOCS at concentrations above the TLV-TWA values listed in Table 4-5.

4.1.3.2 Metals

None of the indoor air samples contained metals at concentrations above the TLV-TWA values listed in Table 4-5. However, lead and copper were found at concentrations approximately three to four times greater than was found at the background location.

4.1.3.3 Other Constituents

None of the indoor air samples contained asbestos concentrations above the 0.5 fiber/cc level listed in Table 4-5.

4.1.4 Soil

The discussion of soils is divided into surface soils and subsurface soils within each chemical class. Surface soil is defined as soil that exists from 0 to 2 inches below the ground surface or organic matter. Subsurface soil occurs below 2 inches.

NYSDEC Technical and Administrative Guidance Memorandum (TAGM) HWR-94-4046 (revised January 24, 1994) values were determined to be the most appropriate as a basis of comparison for the soil sample results. For metals, the values used for comparison are from the NYSDEC TAGM, or the background concentration determined from the SEDA-wide database of 57 background samples, whichever was higher.

Summary statistics for the surface soil, subsurface soil, and downwind surface soil analyses are shown in Tables 4-6, 4-7, and 4-8.

4.1.4.1 Volatile Organic Compounds

Surface Soils

A total of 43 surface soil samples (39 at surface soil locations and four at soil boring locations) were obtained at the site (Table 4-9). [The eleven additional surface soil samples were collected along the downwind transect between SEAD-16 and SEAD-17 will be discussed separately.] Summary statistics information indicates that acetone, carbon disulfide, chloroform, and methylene chloride, which are common laboratory contaminants, were detected in some of the surface soil samples at low concentrations. However, since these compounds appear in laboratory blanks, they are not believed to be representative of the true soil chemistry.

Benzene was detected in four of the 43 surface soil samples at a maximum concentration of 5 µg/kg in SS16-36. The NYSDEC TAGM criteria for benzene is 60 µg/kg. Toluene was detected in 17 of the surface soil samples at concentrations below the NYSDEC TAGM value of 1500 µg/kg. A maximum concentration of 10 µg/kg was detected in SB16-4. Xylene was detected in only one sample at a concentration of 3 µg/kg, which is well below the NYSDEC TAGM criteria of 1200 µg/kg.

Detection limits for all VOC compounds were below the respective TAGM values.

In addition to the NYSDEC TCL-listed VOCs, Tentatively Identified Compounds (TIC)s were detected in the surface soil samples (Table 4-10). The highest concentration of TICs in a surface soil sample (SS16-7) was 5310 µg/kg. Sample SS16-7 also had the highest total VOC concentration (5310 µg/kg), which is the total of TCL-listed compounds and TICs. This concentration is well below the NYSDEC TAGM criteria value of 10,000 µg/kg for total VOCs in soil.

<u>**Subsurface Soils**</u>

VOCs were detected in five of the six subsurface soil samples collected at the site (Table 4-11) Four different VOCs were detected in the samples. Toluene were the most prevalent type of VOC present; this compound was detected in four samples.

Benzene was detected in soil samples from the two soil borings SB16-2 and SB16-4, which were located near the Abandoned Deactivation Furnace. Benzene was present at a concentration of 2 µg/kg in SB16-2 from a depth of 1-2 feet and at location SB16-4 from a depth of 2-4 feet; this concentration is below the NYSDEC TAGM 60 µg/kg. Toluene was detected in four samples that ranged in depth from 1 to 4 feet. However, none of the samples exceeded the NYSDEC TAGM of 1,500 µg/kg.

Since 2-butanone and acetone appear in laboratory blanks, they are likely laboratory contaminants Both of these compounds were generally detected at low concentrations on-site and are not believed to be representative of the true soil chemistry at SEAD-16. Acetone was detected at a concentration of 46 µg/kg from 2-4 feet in soil boring SB16-4. This concentration was below the NYSDEC TAGM criteria value of 200 µg/kg.

Detection limits for all VOC compounds were below the respective TAGM values.

Table 4-6
SEAD-16 Summary Statistics for Surface Soil Samples

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
VOLATILE ORGANICS								
1,1,1-Trichloroethane	UG/KG	43	0	0%				
1,1,2,2-Tetrachloroethane	UG/KG	43	1	2%	10	10	10	0
1,1,2-Trichloroethane	UG/KG	43	0	0%				
1,1-Dichloroethane	UG/KG	43	0	0%				
1,1-Dichloroethene	UG/KG	43	0	0%				
1,2-Dichloroethane	UG/KG	43	0	0%				
1,2-Dichloroethene (total)	UG/KG	43	0	0%				
1,2-Dichloropropane	UG/KG	43	0	0%				
2-Butanone	UG/KG	43	0	0%				
2-Hexanone	UG/KG	43	0	0%				
4-Methyl-2-Pentanone	UG/KG	43	0	0%				
Acetone	UG/KG	43	2	4%	7	17	12	7.071
Benzene	UG/KG	43	4	9%	2	5	2.75	1.5
Bromodichloromethane	UG/KG	43	0	0%				
Bromoform	UG/KG	43	0	0%				
Bromomethane	UG/KG	43	0	0%				
Carbon Disulfide	UG/KG	43	3	7%	1	2	1.667	0.577
Carbon Tetrachloride	UG/KG	43	0	0%				
Chlorobenzene	UG/KG	43	0	0%				
Chloroethane	UG/KG	43	0	0%				
Chloroform	UG/KG	43	2	4%	2	2	2	0
Chloromethane	UG/KG	43	0	0%				
Dibromochloromethane	UG/KG	43	0	0%				
Ethylbenzene	UG/KG	43	0	0%				
Methylene Chloride	UG/KG	43	3	7%	2	3	2.667	0.577
Styrene	UG/KG	43	0	0%				
Tetrachloroethene	UG/KG	43	0	0%				
Toluene	UG/KG	43	17	38%	1	10	3.529	2.672
Trichloroethene	UG/KG	43	0	0%				
Vinyl Chloride	UG/KG	43	0	0%				
Xylene (total)	UG/KG	43	1	2%	3	3	3	0
cis-1,3-Dichloropropene	UG/KG	43	0	0%				
trans-1,3-Dichloropropene	UG/KG	43	0	0%				
SEMIVOLATILE ORGANICS		43						
1,2,4-Trichlorobenzene	UG/KG	43	0	0%				
1,2-Dichlorobenzene	UG/KG	43	0	0%				
1,3-Dichlorobenzene	UG/KG	43	0	0%				
1,4-Dichlorobenzene	UG/KG	43	0	0%				
2,2'-oxybis(1-Chloropropane)	UG/KG	43	0	0%				
2,4,5-Trichlorophenol	UG/KG	43	0	0%				

Table 4-6
SEAD-16 Summary Statistics for Surface Soil Samples

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
2,4,6-Trichlorophenol	UG/KG	43	0	0%				
2,4-Dichlorophenol	UG/KG	43	0	0%				
2,4-Dimethylphenol	UG/KG	43	0	0%				
2,4-Dinitrophenol	UG/KG	43	0	0%				
2,4-Dinitrotoluene	UG/KG	43	17	38%	39	85000	8907.176	20405.23
2,6-Dinitrotoluene	UG/KG	43	11	24%	51	8000	1162.455	2322.508
2-Chloronaphthalene	UG/KG	43	0	0%				
2-Chlorophenol	UG/KG	43	0	0%				
2-Methylnaphthalene	UG/KG	43	9	20%	19	19000	2249.778	6283.51
2-Methylphenol	UG/KG	43	0	0%				
2-Nitroaniline	UG/KG	43	0	0%				
2-Nitrophenol	UG/KG	43	0	0%				
3,3'-Dichlorobenzidine	UG/KG	43	1	2%	850	850	850	0
3-Nitroaniline	UG/KG	43	1	2%	2100	2100	2100	0
4,6-Dinitro-2-methylphenol	UG/KG	43	0	0%				
4-Bromophenyl-phenylether	UG/KG	43	0	0%				
4-Chloro-3-methylphenol	UG/KG	43	0	0%				
4-Chloroaniline	UG/KG	43	0	0%				
4-Chlorophenyl-phenylether	UG/KG	43	0	0%				
4-Methylphenol	UG/KG	43	0	0%				
4-Nitroaniline	UG/KG	43	0	0%				
4-Nitrophenol	UG/KG	43	0	0%				
Acenaphthene	UG/KG	43	8	18%	30	72000	9055.25	25433.54
Acenaphthylene	UG/KG	43	7	16%	19	310	95.143	103.203
Anthracene	UG/KG	43	12	27%	27	120000	10125.83	34601.59
Benzo(a)anthracene	UG/KG	43	20	44%	17	220000	11440.15	49093.46
Benzo(a)pyrene	UG/KG	43	22	49%	17	200000	9681.5	42520.7
Benzo(b)fluoranthene	UG/KG	43	22	49%	17	200000	9773.864	42502.05
Benzo(g,h,i)perylene	UG/KG	43	15	33%	19	100000	7391.4	25667.85
Benzo(k)fluoranthene	UG/KG	43	19	42%	16	170000	9381.579	38901.15
Butylbenzylphthalate	UG/KG	43	0	0%				
Carbazole	UG/KG	43	11	24%	22	89000	8184.455	26803.71
Chrysene	UG/KG	43	27	60%	16	220000	8544	42263.8
Di-n-butylphthalate	UG/KG	43	17	38%	19	16000	1541	3776.333
Di-n-octylphthalate	UG/KG	43	0	0%				
Dibenz(a,h)anthracene	UG/KG	43	9	20%	26	49000	5806	16201.29
Dibenzofuran	UG/KG	43	9	20%	21	50000	5616.778	16643.74
Diethylphthalate	UG/KG	43	2	4%	16	19	17.5	2.121
Dimethylphthalate	UG/KG	43	0	0%				
Fluoranthene	UG/KG	43	28	62%	21	530000	19487.32	100054.6
Fluorene	UG/KG	43	5	11%	24	78000	15656.8	34850.92

Table 4-6
SEAD-16 Summary Statistics for Surface Soil Samples

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
Hexachlorobenzene	UG/KG	43	0	0%				
Hexachlorobutadiene	UG/KG	43	0	0%				
Hexachlorocyclopentadiene	UG/KG	43	0	0%				
Hexachloroethane	UG/KG	43	0	0%				
Indeno(1,2,3-cd)pyrene	UG/KG	43	12	27%	22	100000	9074.5	28662.75
Isophorone	UG/KG	43	0	0%				
N-Nitroso-di-n-propylamine	UG/KG	43	0	0%				
N-Nitrosodiphenylamine (1)	UG/KG	43	18	40%	17	25000	1904.556	5790.378
Naphthalene	UG/KG	43	7	16%	18	66000	9546.714	24893.82
Nitrobenzene	UG/KG	43	0	0%				
Pentachlorophenol	UG/KG	43	1	2%	1200	1200	1200	0
Phenanthrene	UG/KG	43	23	51%	19	490000	21641.52	102099.7
Phenol	UG/KG	43	0	0%				
Pyrene	UG/KG	43	28	6500%	19	360000	13420.75	67928.24
bis(2-Chloroethoxy) methane	UG/KG	43	0	0%				
bis(2-Chloroethyl) ether	UG/KG	43	0	0%				
bis(2-Chloroisopropyl) ether	UG/KG	43	0	0%				
bis(2-Ethylhexyl)phthalate	UG/KG	43	11	24%	24	2100	589.182	624.746
PESTICIDES/PCB		43						
4,4'-DDD	UG/KG	43	8	18%	1.6	23	8.169	7.841
4,4'-DDE	UG/KG	43	33	73%	2	1400	90.861	244.272
4,4'-DDT	UG/KG	43	34	76%	1.8	340	49.941	95.814
Aldrin	UG/KG	43	2	4%	2.8	5	3.9	1.556
Aroclor-1016	UG/KG	43	0	0%				
Aroclor-1221	UG/KG	43	0	0%				
Aroclor-1232	UG/KG	43	0	0%				
Aroclor-1242	UG/KG	43	0	0%				
Aroclor-1248	UG/KG	43	0	0%				
Aroclor-1254	UG/KG	43	2	4%	280	1100	690	579.828
Aroclor-1260	UG/KG	43	9	20%	22	340	149.667	109.206
Dieldrin	UG/KG	43	2	4%	4.3	26	15.15	15.344
Endosulfan I	UG/KG	43	18	40%	0.96	33	8.576	9.327
Endosulfan II	UG/KG	43	5	11%	2.2	5	3.7	1.342
Endosulfan sulfate	UG/KG	43	1	2%	2.1	2.1	2.1	0
Endrin	UG/KG	43	4	9%	2.2	9.9	6.9	3.473
Endrin aldehyde	UG/KG	43	6	13%	3	14	6.008	4.102
Endrin ketone	UG/KG	43	4	9%	1.7	3.6	3	0.876
Heptachlor	UG/KG	43	1	2%	1.8	1.8	1.8	0
Heptachlor epoxide	UG/KG	43	6	13%	1	6.7	2.433	2.119
Methoxychlor	UG/KG	43	0	0%				
Toxaphene	UG/KG	43	1	2%	180	180	180	0

Table 4-6
SEAD-16 Summary Statistics for Surface Soil Samples

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
alpha-BHC	UG/KG	43	0	0%				
alpha-Chlordane	UG/KG	43	13	29%	1.3	170	20.308	45.203
beta-BHC	UG/KG	43	2	4%	1.3	2.3	1.8	0.707
delta-BHC	UG/KG	43	0	0%				
gamma-BHC (Lindane)	UG/KG	43	1	2%	2.3	2.3	2.3	0
gamma-Chlordane	UG/KG	43	13	29%	1.3	200	22.2	53.632
OTHER ANALYSES								
Nitrate/Nitrite-Nitrogen	MG/KG	43	42	98%	0.01	4.8	0.381	0.82
Percent Moisture (PEST/PCB)		27	27	100%	2	22	7.78	5.06
Percent Moisture (SVOCs)		27	27	100%	2	22	7.78	5.06
Percent Moisture (VOCs)		27	27	100%	1	19	7.855	5.03
Percent Solids (Metals)		27	27	100%	78	97.7	92.17	5
Total Organic Carbon	MG/KG	3	3	100%	8400	56400	25266.67	26993.58
NITROAROMATICS								
1,3,5-Trinitrobenzene	UG/KG	43	0	0%				
1,3-Dinitrobenzene	UG/KG	43	0	0%				
2,4,6-Trinitrotoluene	UG/KG	43	0	0%				
2,4-Dinitrotoluene	UG/KG	43	27	60%	150	74000	4498.148	14119.75
2,6-Dinitrotoluene	UG/KG	43	3	7%	120	320	190	112.694
2-amino-4,6-Dinitrotoluene	UG/KG	43	1	2%	430	430	430	0
4-amino-2,6-Dinitrotoluene	UG/KG	43	0	0%				
HMX	UG/KG	43	0	0%				
Nitrobenzene	UG/KG	27	0	0%				
RDX	UG/KG	43	0	0%				
Tetryl	UG/KG	43	1	2%	220	220	220	0
METALS								
Aluminum	MG/KG	43	39	91%	3860	17200	10327.95	2889.713
Antimony	MG/KG	43	27	63%	0.5	1930	86.49889	369.2539
Arsenic	MG/KG	43	43	100%	2.9	32.2	7.47907	5.913607
Barium	MG/KG	43	42	98%	33.6	9340	536.9786	1612.774
Beryllium	MG/KG	43	42	98%	0.08	0.91	0.412619	0.158161
Cadmium	MG/KG	43	26	60%	0.11	16.6	1.746538	3.448151
Calcium	MG/KG	43	43	100%	5200	260000	54983.02	51362.29
Chromium	MG/KG	43	42	98%	8.4	47.5	22.83571	9.643545
Cobalt	MG/KG	43	43	100%	4.6	17.8	10.38837	3.053118
Copper	MG/KG	43	43	100%	19	37900	1159.8	5762.667
Cyanide	MG/KG	43	1	2%	1.5	1.5	1.5	0
Iron	MG/KG	43	43	100%	8870	36500	22829.53	5867.399
Lead	MG/KG	43	43	100%	8.5	140000	4543.919	21283.69
Magnesium	MG/KG	43	43	100%	3190	56000	10590.7	9580.323
Manganese	MG/KG	43	43	100%	178	4140	504.8837	589.6594

Table 4-6
SEAD-16 Summary Statistics for Surface Soil Samples

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
Mercury	MG/KG	43	33	77%	0.04	11.4	0.963529	2.046482
Nickel	MG/KG	43	43	100%	12.3	148	35.30233	20.36026
Potassium	MG/KG	43	43	100%	599	2300	1338.419	431.2568
Selenium	MG/KG	43	19	44%	0.13	1.5	0.6665	0.345882
Silver	MG/KG	43	17	40%	0.24	11.1	1.056471	2.616763
Sodium	MG/KG	43	38	88%	49.7	1830	162.6237	283.2337
Thallium	MG/KG	43	14	33%	0.74	16.6	2.186429	4.160443
Vanadium	MG/KG	43	43	100%	8.2	61.9	22.89767	9.358126
Zinc	MG/KG	43	43	100%	42.7	14600	604.6721	2217.551
HERBICIDES								
2.4.5-T	UG/KG	16	2	13%	7.2	8.3	7.75	0.778
2.4.5-TP (Silvex)	UG/KG	16	0	0%				
2.4-D	UG/KG	16	0	0%				
2.4-DB	UG/KG	16	0	0%				
Dalapon	UG/KG	16	0	0%				
Dicamba	UG/KG	16	0	0%				
Dichloroprop	UG/KG	16	0	0%				
Dinoseb	UG/KG	16	0	0%				
MCPA	UG/KG	16	0	0%				
MCPP	UG/KG	16	1	6%	16000	16000	16000	0

Table 4-7
SEAD-16 Summary Statistics for Subsurface Soil Samples

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
VOLATILE ORGANICS								
1,1,1-Trichloroethane	UG/KG	6	0	0%				
1,1,2,2-Tetrachloroethane	UG/KG	6	0	0%				
1,1,2-Trichloroethane	UG/KG	6	0	0%				
1,1-Dichloroethane	UG/KG	6	0	0%				
1,1-Dichloroethene	UG/KG	6	0	0%				
1,2-Dichloroethane	UG/KG	6	0	0%				
1,2-Dichloroethene (total)	UG/KG	6	0	0%				
1,2-Dichloropropane	UG/KG	6	0	0%				
2-Butanone	UG/KG	6	1	17%	5	5	5	0
2-Hexanone	UG/KG	6	0	0%				
4-Methyl-2-Pentanone	UG/KG	6	0	0%				
Acetone	UG/KG	6	2	33%	11	46	28.5	24.749
Benzene	UG/KG	6	2	33%	2	2	2	0
Bromodichloromethane	UG/KG	6	0	0%				
Bromoform	UG/KG	6	0	0%				
Bromomethane	UG/KG	6	0	0%				
Carbon Disulfide	UG/KG	6	0	0%				
Carbon Tetrachloride	UG/KG	6	0	0%				
Chlorobenzene	UG/KG	6	0	0%				
Chloroethane	UG/KG	6	0	0%				
Chloroform	UG/KG	6	0	0%				
Chloromethane	UG/KG	6	0	0%				
Dibromochloromethane	UG/KG	6	0	0%				
Ethylbenzene	UG/KG	6	0	0%				
Methylene Chloride	UG/KG	6	0	0%				
Styrene	UG/KG	6	0	0%				
Tetrachloroethene	UG/KG	6	0	0%				
Toluene	UG/KG	6	4	67%	2	6	3.25	1.893
Trichloroethene	UG/KG	6	0	0%				
Vinyl Chloride	UG/KG	6	0	0%				
Xylene (total)	UG/KG	6	0	0%				
cis-1,3-Dichloropropene	UG/KG	6	0	0%				
trans-1,3-Dichloropropene	UG/KG	6	0	0%				
SEMIVOLATILE ORGANICS								
1,2,4-Trichlorobenzene	UG/KG	6	0	0%				
1,2-Dichlorobenzene	UG/KG	6	0	0%				
1,3-Dichlorobenzene	UG/KG	6	0	0%				
1,4-Dichlorobenzene	UG/KG	6	0	0%				
2,4,5-Trichlorophenol	UG/KG	6	0	0%				

Table 4-7
SEAD-16 Summary Statistics for Subsurface Soil Samples

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
2,4,6-Trichlorophenol	UG/KG	6	0	0%				
2,4-Dichlorophenol	UG/KG	6	0	0%				
2,4-Dimethylphenol	UG/KG	6	0	0%				
2,4-Dinitrophenol	UG/KG	6	0	0%				
2,4-Dinitrotoluene	UG/KG	6	2	33%	67	1700	883.5	1154.705
2,6-Dinitrotoluene	UG/KG	6	1	17%	160	160	160	0
2-Chloronaphthalene	UG/KG	6	0	0%				
2-Chlorophenol	UG/KG	6	0	0%				
2-Methylnaphthalene	UG/KG	6	1	17%	190	190	190	0
2-Methylphenol	UG/KG	6	0	0%				
2-Nitroaniline	UG/KG	6	0	0%				
2-Nitrophenol	UG/KG	6	0	0%				
3,3'-Dichlorobenzidine	UG/KG	6	0	0%				
3-Nitroaniline	UG/KG	6	0	0%				
4,6-Dinitro-2-methylphenol	UG/KG	6	0	0%				
4-Bromophenyl-phenylether	UG/KG	6	0	0%				
4-Chloro-3-methylphenol	UG/KG	6	0	0%				
4-Chloroaniline	UG/KG	6	0	0%				
4-Chlorophenyl-phenylether	UG/KG	6	0	0%				
4-Methylphenol	UG/KG	6	0	0%				
4-Nitroaniline	UG/KG	6	0	0%				
4-Nitrophenol	UG/KG	6	0	0%				
Acenaphthene	UG/KG	6	1	17%	1100	1100	1100	0
Acenaphthylene	UG/KG	6	1	17%	300	300	300	0
Anthracene	UG/KG	6	3	50%	40	2000	783.333	1062.277
Benzo(a)anthracene	UG/KG	6	4	67%	55	6600	1796.25	3206.528
Benzo(a)pyrene	UG/KG	6	5	83%	20	6200	1570.6	2650.441
Benzo(b)fluoranthene	UG/KG	6	5	83%	18	6000	1374	2599.381
Benzo(g,h,i)perylene	UG/KG	6	5	83%	26	11000	3254	4710.381
Benzo(k)fluoranthene	UG/KG	6	5	83%	20	5600	1296	2421.473
Butylbenzylphthalate	UG/KG	6	1	17%	18	18	18	0
Carbazole	UG/KG	6	1	17%	730	730	730	0
Chrysene	UG/KG	6	5	83%	22	7000	1542.4	3056.076
Di-n-butylphthalate	UG/KG	6	2	33%	35	240	137.5	144.957
Di-n-octylphthalate	UG/KG	6	0	0%				
Dibenz(a,h)anthracene	UG/KG	6	4	67%	32	2500	1113	1188.044
Dibenzofuran	UG/KG	6	2	33%	45	270	157.5	159.099
Diethylphthalate	UG/KG	6	0	0%				
Dimethylphthalate	UG/KG	6	0	0%				
Fluoranthene	UG/KG	6	5	83%	32	13000	2762.4	5725.499

Table 4-7
SEAD-16 Summary Statistics for Subsurface Soil Samples

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
Fluorene	UG/KG	6	1	17%	800	800	800	0
Hexachlorobenzene	UG/KG	6	0	0%				
Hexachlorobutadiene	UG/KG	6	0	0%				
Hexachlorocyclopentadiene	UG/KG	6	0	0%				
Hexachloroethane	UG/KG	6	0	0%				
Indeno(1,2,3-cd)pyrene	UG/KG	6	5	83%	24	7100	2319.8	3121.6
Isophorone	UG/KG	6	0	0%				
N-Nitroso-di-n-propylamine	UG/KG	6	0	0%				
N-Nitrosodiphenylamine (1)	UG/KG	6	1	17%	530	530	530	0
Naphthalene	UG/KG	6	1	17%	120	120	120	0
Nitrobenzene	UG/KG	6	0	0%				
Pentachlorophenol	UG/KG	6	1	17%	120	120	120	0
Phenanthrene	UG/KG	6	5	83%	23	7600	1608.6	3349.767
Phenol	UG/KG	6	0	0%				
Pyrene	UG/KG	6	5	83%	25	11000	2363	4832.605
bis(2-Chloroethoxy) methane	UG/KG	6	0	0%				
bis(2-Chloroethyl) ether	UG/KG	6	0	0%				
bis(2-Chloroisopropyl) ether	UG/KG	6	0	0%				
bis(2-Ethylhexyl)phthalate	UG/KG	6	1	17%	110	110	110	0
PESTICIDES/PCB								
4,4'-DDD	UG/KG	6	0	0%				
4,4'-DDE	UG/KG	6	1	17%	8.3	8.3	8.3	0
4,4'-DDT	UG/KG	6	2	33%	1.7	3.4	2.55	1.202
Aldrin	UG/KG	6	0	0%				
Aroclor-1016	UG/KG	6	0	0%				
Aroclor-1221	UG/KG	6	0	0%				
Aroclor-1232	UG/KG	6	0	0%				
Aroclor-1242	UG/KG	6	0	0%				
Aroclor-1248	UG/KG	6	0	0%				
Aroclor-1254	UG/KG	6	0	0%				
Aroclor-1260	UG/KG	6	0	0%				
Dieldrin	UG/KG	6	1	17%	12	12	12	0
Endosulfan I	UG/KG	6	2	33%	2.4	7.3	4.85	3.465
Endosulfan II	UG/KG	6	0	0%				
Endosulfan sulfate	UG/KG	6	0	0%				
Endrin	UG/KG	6	1	17%	2.9	2.9	2.9	0
Endrin aldehyde	UG/KG	6	0	0%				
Endrin ketone	UG/KG	6	0	0%				
Heptachlor	UG/KG	6	0	0%				
Heptachlor epoxide	UG/KG	6	0	0%				

Table 4-7
SEAD-16 Summary Statistics for Subsurface Soil Samples

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
Methoxychlor	UG/KG	6	0	0%				
Toxaphene	UG/KG	6	0	0%				
alpha-BHC	UG/KG	6	0	0%				
alpha-Chlordane	UG/KG	6	0	0%				
beta-BHC	UG/KG	6	0	0%				
delta-BHC	UG/KG	6	0	0%				
gamma-BHC (Lindane)	UG/KG	6	0	0%				
gamma-Chlordane	UG/KG	6	0	0%				
OTHER ANALYSES								
Nitrate/Nitrite-Nitrogen	MG/KG	6	6	100%	0.09	0.78	0.295	0.256
Percent Moisture (PEST/PCB)		6	6	100%	4	15	11	3.847
Percent Moisture (SVOCs)		6	6	100%	4	15	11	3.847
Percent Moisture (VOCs)		6	6	100%	6	16	11.667	3.386
Percent Solids (Metals)		6	6	100%	85.3	95.6	88.983	3.581
Total Organic Carbon	MG/KG	3	3	100%	668	9850	3842.667	5205.313
NITROAROMATICS								
1,3,5-Trinitrobenzene	UG/KG	6	0	0%				
1,3-Dinitrobenzene	UG/KG	6	0	0%				
2,4,6-Trinitrotoluene	UG/KG	6	0	0%				
2,4-Dinitrotoluene	UG/KG	6	3	50%	150	500	310	176.918
2,6-Dinitrotoluene	UG/KG	6	0	0%				
2-amino-4,6-Dinitrotoluene	UG/KG	6	0	0%				
4-amino-2,6-Dinitrotoluene	UG/KG	6	0	0%				
HMX	UG/KG	6	0	0%				
Nitrobenzene	UG/KG	6	0	0%				
RDX	UG/KG	6	0	0%				
Tetryl	UG/KG	6	0	0%				
METALS								
Aluminum	MG/KG	6	1	17%	12800	12800	12800	0
Antimony	MG/KG	6	3	50%	3.3	135	48.867	74.636
Arsenic	MG/KG	6	6	100%	3.3	6.9	5.6	1.391
Barium	MG/KG	6	6	100%	51.8	302	143.083	91.937
Beryllium	MG/KG	6	6	100%	0.29	0.51	0.38	0.088
Cadmium	MG/KG	6	5	83%	0.06	0.45	0.176	0.161
Calcium	MG/KG	6	6	100%	22500	97900	45766.67	30669.83
Chromium	MG/KG	6	6	100%	15.4	21.1	18.383	2.264
Cobalt	MG/KG	6	6	100%	7	12.2	10.7	1.951
Copper	MG/KG	6	6	100%	16.4	736	179.167	281.947
Cyanide	MG/KG	6	1	17%	0.52	0.52	0.52	0
Iron	MG/KG	6	6	100%	20700	31400	24433.33	4159.647

Table 4-7
SEAD-16 Summary Statistics for Subsurface Soil Samples

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
Lead	MG/KG	6	6	100%	12.6	35400	6099.267	14357.43
Magnesium	MG/KG	6	6	100%	6230	13300	9715	3095.033
Manganese	MG/KG	6	6	100%	210	650	470.667	176.716
Mercury	MG/KG	6	4	67%	0.04	1.9	0.74	0.805
Nickel	MG/KG	6	6	100%	23.8	37	29.85	5.402
Potassium	MG/KG	6	6	100%	1160	1990	1400	309.58
Selenium	MG/KG	6	3	50%	0.64	1.2	0.887	0.286
Silver	MG/KG	6	2	33%	0.25	1.2	0.725	0.672
Sodium	MG/KG	6	3	50%	59.2	160	100.7	52.705
Thallium	MG/KG	6	1	17%	0.91	0.91	0.91	0
Vanadium	MG/KG	6	6	100%	15.2	22.6	18.567	2.541
Zinc	MG/KG	6	6	100%	54.8	183	113.65	51.698

Table 4-8
Summary Statistics for Downwind Samples

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
VOLATILE ORGANICS								
1,1,1-Trichloroethane	UG/KG	9	0	0%				
1,1,2,2-Tetrachloroethane	UG/KG	9	0	0%				
1,1,2-Trichloroethane	UG/KG	9	0	0%				
1,1-Dichloroethane	UG/KG	9	0	0%				
1,1-Dichloroethene	UG/KG	9	0	0%				
1,2-Dichloroethane	UG/KG	9	0	0%				
1,2-Dichloroethene (total)	UG/KG	9	0	0%				
1,2-Dichloropropane	UG/KG	9	0	0%				
2-Butanone	UG/KG	9	0	0%				
2-Hexanone	UG/KG	9	0	0%				
4-Methyl-2-Pentanone	UG/KG	9	0	0%				
Acetone	UG/KG	9	0	0%				
Benzene	UG/KG	9	1	11%	2	2	2	0
Bromodichloromethane	UG/KG	9	0	0%				
Bromoform	UG/KG	9	0	0%				
Bromomethane	UG/KG	9	0	0%				
Carbon Disulfide	UG/KG	9	0	0%				
Carbon Tetrachloride	UG/KG	9	0	0%				
Chlorobenzene	UG/KG	9	0	0%				
Chloroethane	UG/KG	9	0	0%				
Chloroform	UG/KG	9	0	0%				
Chloromethane	UG/KG	9	0	0%				
Dibromochloromethane	UG/KG	9	0	0%				
Ethylbenzene	UG/KG	9	0	0%				
Methylene Chloride	UG/KG	9	0	0%				
Styrene	UG/KG	9	0	0%				
Tetrachloroethene	UG/KG	9	0	0%				
Toluene	UG/KG	9	2	22%	2	3	2.5	0.707
Trichloroethene	UG/KG	9	0	0%				
Vinyl Chloride	UG/KG	9	0	0%				
Xylene (total)	UG/KG	9	0	0%				
cis-1,3-Dichloropropene	UG/KG	9	0	0%				
trans-1,3-Dichloropropene	UG/KG	9	0	0%				
SEMIVOLATILE ORGANICS								
1,2,4-Trichlorobenzene	UG/KG	9	0	0%				
1,2-Dichlorobenzene	UG/KG	9	0	0%				
1,3-Dichlorobenzene	UG/KG	9	0	0%				
1,4-Dichlorobenzene	UG/KG	9	0	0%				

Table 4-8
Summary Statistics for Downwind Samples

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
2,4,5-Trichlorophenol	UG/KG	9	0	0%				
2,4,6-Trichlorophenol	UG/KG	9	0	0%				
2,4-Dichlorophenol	UG/KG	9	0	0%				
2,4-Dimethylphenol	UG/KG	9	0	0%				
2,4-Dinitrophenol	UG/KG	9	0	0%				
2,4-Dinitrotoluene	UG/KG	9	2	22%	400	880	640	339.411
2,6-Dinitrotoluene	UG/KG	9	0	0%				
2-Chloronaphthalene	UG/KG	9	0	0%				
2-Chlorophenol	UG/KG	9	0	0%				
2-Methylnaphthalene	UG/KG	9	1	11%	28	28	28	0
2-Methylphenol	UG/KG	9	1	11%	120	120	120	0
2-Nitroaniline	UG/KG	9	0	0%				
2-Nitrophenol	UG/KG	9	0	0%				
3,3'-Dichlorobenzidine	UG/KG	9	0	0%				
3-Nitroaniline	UG/KG	9	0	0%				
4,6-Dinitro-2-methylphenol	UG/KG	9	0	0%				
4-Bromophenyl-phenylether	UG/KG	9	0	0%				
4-Chloro-3-methylphenol	UG/KG	9	0	0%				
4-Chloroaniline	UG/KG	9	0	0%				
4-Chlorophenyl-phenylether	UG/KG	9	0	0%				
4-Methylphenol	UG/KG	9	0	0%				
4-Nitroaniline	UG/KG	9	0	0%				
4-Nitrophenol	UG/KG	9	0	0%				
Acenaphthene	UG/KG	9	2	22%	18	33	25.5	10.607
Acenaphthylene	UG/KG	9	2	22%	35	96	65.5	43.134
Anthracene	UG/KG	9	2	22%	110	130	120	14.142
Benzo(a)anthracene	UG/KG	9	8	89%	19	720	188.25	262.752
Benzo(a)pyrene	UG/KG	9	8	89%	22	940	244.375	347.128
Benzo(b)fluoranthene	UG/KG	9	7	78%	42	2200	446	796.979
Benzo(g,h,i)perylene	UG/KG	9	8	89%	35	710	208	262.855
Benzo(k)fluoranthene	UG/KG	9	7	78%	38	530	129.714	177.428
Butylbenzylphthalate	UG/KG	9	0	0%				
Carbazole	UG/KG	9	2	22%	40	85	62.5	31.82
Chrysene	UG/KG	9	8	89%	25	670	197.625	249.603
Di-n-butylphthalate	UG/KG	9	1	11%	90	90	90	0
Di-n-octylphthalate	UG/KG	9	0	0%				
Dibenz(a,h)anthracene	UG/KG	9	7	78%	18	470	120.714	166.189
Dibenzofuran	UG/KG	9	1	11%	36	36	36	0
Diethylphthalate	UG/KG	9	0	0%				

Table 4-8
Summary Statistics for Downwind Samples

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
Dimethylphthalate	UG/KG	9	0	0%				
Fluoranthene	UG/KG	9	8	89%	36	1000	293.625	374.399
Fluorene	UG/KG	9	1	11%	38	38	38	0
Hexachlorobenzene	UG/KG	9	0	0%				
Hexachlorobutadiene	UG/KG	9	0	0%				
Hexachlorocyclopentadiene	UG/KG	9	0	0%				
Hexachloroethane	UG/KG	9	0	0%				
Indeno(1,2,3-cd)pyrene	UG/KG	9	8	89%	20	790	205.875	287.694
Isophorone	UG/KG	9	0	0%				
N-Nitroso-di-n-propylamine	UG/KG	9	0	0%				
N-Nitrosodiphenylamine (1)	UG/KG	9	2	22%	47	95	71	33.941
Naphthalene	UG/KG	9	2	22%	16	29	22.5	9.192
Nitrobenzene	UG/KG	9	0	0%				
Pentachlorophenol	UG/KG	9	0	0%				
Phenanthrene	UG/KG	9	7	78%	34	360	131	144.576
Phenol	UG/KG	9	0	0%				
Pyrene	UG/KG	9	8	89%	38	1200	294.625	411.602
bis(2-Chloroethoxy) methane	UG/KG	9	0	0%				
bis(2-Chloroethyl) ether	UG/KG	9	0	0%				
bis(2-Chloroisopropyl) ether	UG/KG	9	0	0%				
bis(2-Ethylhexyl)phthalate	UG/KG	9	0	0%				
PESTICIDES/PCB								
4,4'-DDD	UG/KG	9	0	0%				
4,4'-DDE	UG/KG	9	4	44%	1.9	140	39	67.394
4,4'-DDT	UG/KG	9	2	22%	6	13	9.5	4.95
Aldrin	UG/KG	9	0	0%				
Aroclor-1016	UG/KG	9	0	0%				
Aroclor-1221	UG/KG	9	0	0%				
Aroclor-1232	UG/KG	9	0	0%				
Aroclor-1242	UG/KG	9	0	0%				
Aroclor-1248	UG/KG	9	0	0%				
Aroclor-1254	UG/KG	9	0	0%				
Aroclor-1260	UG/KG	9	0	0%				
Dieldrin	UG/KG	9	1	11%	8.4	8.4	8.4	0
Endosulfan I	UG/KG	9	3	33%	1.6	430	147.867	244.39
Endosulfan II	UG/KG	9	0	0%				
Endosulfan sulfate	UG/KG	9	1	11%	20	20	20	0
Endrin	UG/KG	9	2	22%	5.6	43	24.3	26.446
Endrin aldehyde	UG/KG	9	0	0%				

Table 4-8
Summary Statististics for Downwind Samples

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
Endrin ketone	UG/KG	9	2	22%	4.8	71	37.9	46.81
Heptachlor	UG/KG	9	0	0%				
Heptachlor epoxide	UG/KG	9	0	0%				
Methoxychlor	UG/KG	9	0	0%				
Toxaphene	UG/KG	9	0	0%				
alpha-BHC	UG/KG	9	0	0%				
alpha-Chlordane	UG/KG	9	1	11%	1.1	1.1	1.1	0
beta-BHC	UG/KG	9	1	11%	20	20	20	0
delta-BHC	UG/KG	9	1	11%	2.2	2.2	2.2	0
gamma-BHC (Lindane)	UG/KG	9	0	0%				
gamma-Chlordane	UG/KG	9	0	0%				
OTHER ANALYSES								
Nitrate/Nitrite-Nitrogen	MG/KG	9	9	100%	0.06	6.1	1.607	2.524
Percent Moisture (PEST/PCB)		9	9	100%	3	19	12.333	5.074
Percent Moisture (SVOCs)		9	9	100%	3	19	12.333	5.074
Percent Moisture (VOCs)		9	9	100%	3	20	13.222	5.472
Percent Solids (Metals)		9	9	100%	81.4	97.2	87.533	5.096
NITROAROMATICS								
1,3,5-Trinitrobenzene	UG/KG	9	0	0%				
1,3-Dinitrobenzene	UG/KG	9	0	0%				
2,4,6-Trinitrotoluene	UG/KG	9	0	0%				
2,4-Dinitrotoluene	UG/KG	9	0	0%				
2,6-Dinitrotoluene	UG/KG	9	1	11%	900	900	900	0
2-amino-4,6-Dinitrotoluene	UG/KG	9	0	0%				
4-amino-2,6-Dinitrotoluene	UG/KG	9	0	0%				
HMX	UG/KG	9	0	0%				
Nitrobenzene	UG/KG	9	0	0%				
RDX	UG/KG	9	0	0%				
Tetryl	UG/KG	9	0	0%				
METALS								
Aluminum	MG/KG	9	9	100%	4120	14100	11115.56	3072.634
Antimony	MG/KG	9	6	67%	0.36	0.8	0.643	0.16
Arsenic	MG/KG	9	9	100%	3.8	5.6	4.733	0.512
Barium	MG/KG	9	9	100%	27.2	129	89.389	29.462
Beryllium	MG/KG	9	9	100%	0.16	0.57	0.429	0.126
Cadmium	MG/KG	9	9	100%	0.07	0.34	0.208	0.088
Calcium	MG/KG	9	9	100%	3410	229000	44397.78	76597.22
Chromium	MG/KG	9	9	100%	9.3	24.4	17.067	4.353
Cobalt	MG/KG	9	9	100%	4.7	15.7	9.333	3.346

Table 4-8
Summary Statistics for Downwind Samples

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
Copper	MG/KG	9	9	100%	14.9	39	23.278	7.689
Cyanide	MG/KG	9	0	0%				
Iron	MG/KG	9	9	100%	9760	29300	20895.56	5729.413
Lead	MG/KG	9	9	100%	16.7	58	31.878	15.107
Magnesium	MG/KG	9	9	100%	3200	8430	5401.111	1751.288
Manganese	MG/KG	9	9	100%	286	704	541	138.605
Mercury	MG/KG	9	8	89%	0.05	0.56	0.125	0.176
Nickel	MG/KG	9	9	100%	15.8	50.8	25.756	11.386
Potassium	MG/KG	9	9	100%	848	1730	1264.222	274.017
Selenium	MG/KG	9	9	100%	0.5	1.5	1.171	0.332
Silver	MG/KG	9	0	0%				
Sodium	MG/KG	9	4	44%	49.4	383	146.1	158.536
Thallium	MG/KG	9	3	33%	0.83	1.2	1.01	0.185
Vanadium	MG/KG	9	9	100%	15.5	22.3	19.456	1.795
Zinc	MG/KG	9	9	100%	53.2	109	77.989	20.701

Table 4-9
SEAD-16 Summary of Analytes Detected in Surface Soil

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SB16-1		SB16-3		SB16-3		SB16-4		SS16-1		SS16-10	
			SAMP ID:	16037		16032		16033		16030		SS16-1-1		SS16-10-1	
			QC CODE:	SA		SA		DU		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		ESI		ESI	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/14/96		8/14/96		8/14/96		8/14/96		10/20/93		11/9/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
VOLATILE ORGANICS															
1,1,2,2-Tetrachloroethane	600	NYSDEC TAGM	UG/KG	12	U	11	U	10	J	10	U	11	U	11	U
Acetone	200	NYSDEC TAGM	UG/KG	7	J	11	U	22	U	10	U	11	U	11	U
Benzene	60	NYSDEC TAGM	UG/KG	12	U	11	U	10	U	10	U	11	U	11	U
Carbon Disulfide	2700	NYSDEC TAGM	UG/KG	12	U	11	U	2	J	10	U	11	U	11	U
Chloroform	300	NYSDEC TAGM	UG/KG	12	U	11	U	10	U	10	U	11	U	11	U
Methylene Chloride	100	NYSDEC TAGM	UG/KG	12	U	11	U	10	U	10	U	11	U	11	U
Toluene	1500	NYSDEC TAGM	UG/KG	12	U	11	U	2	J	10	J	11	U	11	U
Xylene (total)	1200	NYSDEC TAGM	UG/KG	12	U	11	U	3	J	10	U	11	U	11	U
SEMIVOLATILE ORGANICS															
2,4-Dinitrotoluene			UG/KG	420	U	1800	U	3500	U	1100	U	2200	J	1800	U
2,6-Dinitrotoluene	1000	NYSDEC TAGM	UG/KG	420	U	1800	U	3500	U	1100	U	180	J	1800	U
2-Methylnaphthalene	36400	NYSDEC TAGM	UG/KG	420	U	1800	U	3500	U	71	J	710	UR	1800	U
3,3'-Dichlorobenzidine			UG/KG	420	U	1800	U	3500	U	1100	U	710	UR	1800	U
3-Nitroaniline	500	NYSDEC TAGM	UG/KG	1000	U	4200	U	8400	U	2800	U	1700	UR	4300	U
Acenaphthene	50000	NYSDEC TAGM	UG/KG	420	U	1800	U	3500	U	72	J	710	UR	1800	U
Acenaphthylene	41000	NYSDEC TAGM	UG/KG	420	U	1800	U	3500	U	310	J	70	J	1800	U
Anthracene	50000	NYSDEC TAGM	UG/KG	420	U	1800	U	3500	U	390	J	82	J	1800	U
Benzo(a)anthracene	224	NYSDEC TAGM	UG/KG	420	U	1800	U	3500	U	**1800**		**420**	**J**	1800	U
Benzo(a)pyrene	61	NYSDEC TAGM	UG/KG	420	U	1800	U	3500	U	**4400**		**560**	**J**	1800	U
Benzo(b)fluoranthene	1100	NYSDEC TAGM	UG/KG	420	U	1800	U	3500	U	**3800**		480	J	1800	U
Benzo(g,h,i)perylene	50000	NYSDEC TAGM	UG/KG	32	J	900	J	340	J	6300		160	J	1800	U
Benzo(k)fluoranthene	1100	NYSDEC TAGM	UG/KG	420	U	1800	U	3500	U	**2300**		740	J	1800	U
Carbazole			UG/KG	420	U	1800	U	3500	U	100	J	710	UR	1800	U
Chrysene	400	NYSDEC TAGM	UG/KG	420	U	96	J	3500	U	**2100**		**500**	**J**	1800	U

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-9
SEAD-16 Summary of Analytes Detected in Surface Soil

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SB16-1		SB16-3		SB16-3		SB16-4		SS16-1		SS16-10	
			SAMP ID:	16037		16032		16033		16030		SS16-1-1		SS16-10-1	
			QC CODE:	SA		SA		DU		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		ESI		ESI	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/14/96		8/14/96		8/14/96		8/14/96		10/20/93		11/9/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Di-n-butylphthalate	8100	NYSDEC TAGM	UG/KG	420	U	1800	U	3500	U	150	J	1300	J	120	J
Dibenz(a,h)anthracene	14	NYSDEC TAGM	UG/KG	**26**	**J**	**260**	**J**	**220**	**J**	**1100**	**J**	710	UR	1800	U
Dibenzofuran	6200	NYSDEC TAGM	UG/KG	420	U	1800	U	3500	U	1100	U	710	UR	1800	U
Diethylphthalate	7100	NYSDEC TAGM	UG/KG	420	U	1800	U	3500	U	1100	U	710	UR	1800	U
Fluoranthene	50000	NYSDEC TAGM	UG/KG	420	U	91	J	3500	U	1800		470	J	1800	U
Fluorene	50000	NYSDEC TAGM	UG/KG	420	U	1800	U	3500	U	1100	U	710	UR	1800	U
Indeno(1,2,3-cd)pyrene	3200	NYSDEC TAGM	UG/KG	32	J	470	J	320	J	**4600**		710	UR	1800	U
N-Nitrosodiphenylamine (1)			UG/KG	420	U	1800	U	3500	U	1100	U	680	J	1800	U
Naphthalene	13000	NYSDEC TAGM	UG/KG	420	U	1800	U	3500	U	180	J	710	UR	1800	U
Pentachlorophenol	1000	NYSDEC TAGM	UG/KG	1000	U	4200	U	8400	U	2800	U	1700	UR	4300	U
Phenanthrene	50000	NYSDEC TAGM	UG/KG	420	U	1800	U	3500	U	620	J	140	J	1800	U
Pyrene	50000	NYSDEC TAGM	UG/KG	420	U	1800	U	3500	U	2100		980	J	1800	U
bis(2-Ethylhexyl)phthalate	50000	NYSDEC TAGM	UG/KG	30	J	1800	U	3500	U	67	J	710	UR	1800	U
PESTICIDES/PCB															
4,4'-DDD	2900	NYSDEC TAGM	UG/KG	4.2	U	3.5	U	3.5	U	35	U	5	J	3.6	UJ
4,4'-DDE	2100	NYSDEC TAGM	UG/KG	4.2	U	2	J	3.5	U	35	U	19	J	3.6	UJ
4,4'-DDT	2100	NYSDEC TAGM	UG/KG	4.2	U	3.5	U	3.5	U	35	U	12	J	3.6	UJ
Aldrin	41	NYSDEC TAGM	UG/KG	2.2	U	1.8	U	1.8	U	18	U	1.8	UJ	1.8	UJ
Aroclor-1254	1000	NYSDEC TAGM	UG/KG	42	U	35	U	35	U	350	U	30	UJ	36	UJ
Aroclor-1260	1000	NYSDEC TAGM	UG/KG	42	U	35	U	35	U	350	U	35	U	36	UJ
Dieldrin	44	NYSDEC TAGM	UG/KG	4.2	U	3.5	U	3.5	U	26	J	3.5	UJ	3.6	UJ
Endosulfan I	900	NYSDEC TAGM	UG/KG	1.4	U	1.2	U	1.8	U	25	J	14	J	1.8	UJ
Endosulfan II	900	NYSDEC TAGM	UG/KG	4.2	U	3.5	U	3.5	U	35	U	4.4	J	3.6	UJ
Endosulfan sulfate	1000	NYSDEC TAGM	UG/KG	4.2	U	3.5	U	3.5	U	35	U	3.5	UJ	3.6	UJ
Endrin	100	NYSDEC TAGM	UG/KG	2.2	U	3.5	U	3.5	U	35	U	3.5	UJ	3.6	UJ

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-9
SEAD-16 Summary of Analytes Detected in Surface Soil

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SB16-1		SB16-3		SB16-3		SB16-4		SS16-1		SS16-10	
			SAMP ID:	16037		16032		16033		16030		SS16-1-1		SS16-10-1	
			QC CODE:	SA		SA		DU		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		ESI		ESI	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/14/96		8/14/96		8/14/96		8/14/96		10/20/93		11/9/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Endrin aldehyde			UG/KG	4.2	U	3.5	U	3.5	U	35	U	3	J	3.6	UJ
Endrin ketone			UG/KG	4.2	U	3.5	U	3.5	U	35	U	3.4	J	3.6	UJ
Heptachlor	100	NYSDEC TAGM	UG/KG	2.2	U	1.8	U	1.8	U	18	U	1.8	UJ	1.8	UJ
Heptachlor epoxide	20	NYSDEC TAGM	UG/KG	1.6	J	1.8	U	1.8	U	18	U	1.8	UJ	1.8	UJ
Toxaphene			UG/KG	220	U	180	U	180	U	1800	U	180	UJ	180	UJ
alpha-Chlordane			UG/KG	2.2	U	1.8	U	1.8	U	18	U	1.8	UJ	1.8	UJ
beta-BHC	200	NYSDEC TAGM	UG/KG	2.2	U	1.8	U	1.8	U	18	U	1.8	UJ	1.8	UJ
gamma-BHC (Lindane)	60	NYSDEC TAGM	UG/KG	2.2	U	1.8	U	1.8	U	18	U	1.8	UJ	1.8	UJ
gamma-Chlordane	540	NYSDEC TAGM	UG/KG	2.2	U	1.8	U	1.8	U	18	U	1.8	UJ	1.8	UJ
OTHER ANALYSES															
Nitrate/Nitrite-Nitrogen			MG/KG	2.2		0.01		0.01		0.02		0.05		0.07	
Percent Moisture (PEST/PCB)				22		6		5		5					
Percent Moisture (SVOCs)				22		6		5		4					
Percent Moisture (VOCs)				18		6		5		5					
Percent Solids (Metals)				78		93.8		94.6		95.4					
Total Organic Carbon			MG/KG												
NITROAROMATICS															
2,4-Dinitrotoluene			UG/KG	120	U	6800	J	280	J	2200		320		130	U
2,6-Dinitrotoluene	1000	NYSDEC TAGM	UG/KG	120	U	250	U	120	U	130	J	130	U	130	U
2-amino-4,6-Dinitrotoluene			UG/KG	120	U	250	U	120	U	120	U	130	U	130	U
Tetryl			UG/KG	120	U	250	U	120	U	120	U	130	U	130	U
METALS															
Aluminum	14592.8	NYSDEC TAGM	MG/KG	19700	R	12500	R	11700	R	5100	R	6550		9720	
Antimony	3.59	NYSDEC TAGM	MG/KG	0.42	UJ	0.39	UJ	0.38	UJ	1.6	J	**17.1**		6.6	U
Arsenic	7.5	NYSDEC TAGM	MG/KG	5	J	4	J	3.8	J	3	J	4.9		5.2	J

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-9
SEAD-16 Summary of Analytes Detected in Surface Soil

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SB16-1		SB16-3		SB16-3		SB16-4		SS16-1		SS16-10	
			SAMP ID:	16037		16032		16033		16030		SS16-1-1		SS16-10-1	
			QC CODE:	SA		SA		DU		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		ESI		ESI	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/14/96		8/14/96		8/14/96		8/14/96		10/20/93		11/9/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Barium	300	NYSDEC TAGM	MG/KG	198	J	67.6	J	61.5	J	44.4	J	102		33.6	
Beryllium	0.73	NYSDEC TAGM	MG/KG	0.72		0.41		0.38		0.08		0.32	J	0.36	J
Cadmium	1	NYSDEC TAGM	MG/KG	0.36		0.06	U	0.06	U	0.18		0.44	U	0.41	UR
Calcium	101904	NYSDEC TAGM	MG/KG	6180		30600		45500		76600		**147000**		13800	
Chromium	22.13	NYSDEC TAGM	MG/KG	**24.7**		21.2		20.5		8.6		12.6		13.9	
Cobalt	30	NYSDEC TAGM	MG/KG	14.9	J	12.6	J	13	J	4.6		6.2	J	7.6	
Copper	25	NYSDEC TAGM	MG/KG	19	J	**35.6**	**J**	**33**	**J**	**39.7**	**J**	**44**		**29**	**J**
Cyanide	0.3	NYSDEC TAGM	MG/KG	0.55	UJ	0.52	UJ	0.5	UJ	0.47	UJ	0.64	U	0.53	U
Iron	26626.7	NYSDEC TAGM	MG/KG	**31900**	**J**	**27100**	**J**	25600	J	10900	J	12300		23200	
Lead	21.86	NYSDEC TAGM	MG/KG	**21.9**	**J**	**65.9**	**J**	**51.7**	**J**	**193**	**J**	**269**		16.1	
Magnesium	12221.8	NYSDEC TAGM	MG/KG	4380		8010		9320		**24900**		**34900**		5500	
Manganese	669.38	NYSDEC TAGM	MG/KG	**1060**		397	J	409	J	417	J	355	J	342	
Mercury	0.1	NYSDEC TAGM	MG/KG	**0.1**	**J**	0.05	U	0.04	J	**0.51**	**J**	**0.2**		0.02	U
Nickel	33.62	NYSDEC TAGM	MG/KG	30	J	**40.3**	**J**	**39.7**	**J**	12.3	J	23		22.4	
Potassium	1761.48	NYSDEC TAGM	MG/KG	1710		1690		1590		1060		1290		813	
Selenium	2	NYSDEC TAGM	MG/KG	1.5	J	0.82	J	0.45	UJ	0.44	UJ	0.15	UJ	0.22	UJ
Silver	0.4	NYSDEC TAGM	MG/KG	0.3		0.25	U	0.25	U	0.24		0.9	U	0.84	UJ
Sodium	103.74	NYSDEC TAGM	MG/KG	55.8	U	76.6		99.2		53.4		**213**	**J**	49.7	J
Thallium	0.28	NYSDEC TAGM	MG/KG	**1.8**		0.82	U	0.79	U	**0.77**		1.6	U	0.24	UJ
Vanadium	150	NYSDEC TAGM	MG/KG	33.6	J	22.4	J	20.4	J	11.2	J	36.9		16.9	
Zinc	82.5	NYSDEC TAGM	MG/KG	**99.8**		**84.5**		79.8		**90.4**		**219**		65.8	J
HERBICIDES															
2,4,5-T	1900	NYSDEC TAGM	UG/KG									5.4	U	5.4	U
MCPP			UG/KG									5400	U	5400	U

Note: Shaded values exceed the NYSDEC TAGM.
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Table 4-9
SEAD-16 Summary of Analytes Detected in Surface Soil

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS16-11		SS16-12		SS16-13		SS16-14		SS16-15		SS16-16		SS16-17	
			SAMP ID:	SS16-11-1		SS16-12-1		SS16-13-1		SS16-14-1		SS16-15-1		SS16-16-1		16040	
			QC CODE:	SA		SA		SA		SA		SA		SA		SA	
			STUDY ID:	ESI		ESI		ESI		ESI		ESI		ESI		RI ROUND1	
			TOP:	0		0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	10/20/93		10/20/93		10/20/93		10/20/93		10/20/93		10/20/93		8/19/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
VOLATILE ORGANICS																	
1,1,2,2-Tetrachloroethane	600	NYSDEC TAGM	UG/KG	13	U	11	UJ	11	UJ	11	U	11	UJ	11	U	12	U
Acetone	200	NYSDEC TAGM	UG/KG	13	U	11	UJ	11	UJ	11	U	11	UJ	11	U	6	U
Benzene	60	NYSDEC TAGM	UG/KG	13	U	11	UJ	11	UJ	11	U	11	UJ	11	U	12	U
Carbon Disulfide	2700	NYSDEC TAGM	UG/KG	13	U	11	UJ	11	UJ	11	U	11	UJ	11	U	12	U
Chloroform	300	NYSDEC TAGM	UG/KG	13	U	11	UJ	11	UJ	11	U	11	UJ	11	U	6	U
Methylene Chloride	100	NYSDEC TAGM	UG/KG	13	U	3	J	11	UJ	3	J	11	UJ	11	U	12	U
Toluene	1500	NYSDEC TAGM	UG/KG	13	U	2	J	11	UJ	1	J	11	UJ	11	U	12	U
Xylene (total)	1200	NYSDEC TAGM	UG/KG	13	U	11	UJ	11	UJ	11	U	11	UJ	11	U	12	U
SEMIVOLATILE ORGANICS																	
2,4-Dinitrotoluene			UG/KG	440	U	360	U	750	U	370		350	U	1800	UJ	390	U
2,6-Dinitrotoluene	1000	NYSDEC TAGM	UG/KG	440	U	360	U	750	U	56	J	350	U	1800	UJ	390	U
2-Methylnaphthalene	36400	NYSDEC TAGM	UG/KG	440	U	360	U	750	U	370	U	350	U	1800	UJ	390	U
3,3'-Dichlorobenzidine			UG/KG	440	U	360	U	750	U	370	U	350	U	1800	UJ	390	U
3-Nitroaniline	500	NYSDEC TAGM	UG/KG	1100	U	880	U	1800	U	890	U	860	U	4500	UJ	950	U
Acenaphthene	50000	NYSDEC TAGM	UG/KG	440	U	360	U	750	U	370	U	350	U	1800	UJ	390	U
Acenaphthylene	41000	NYSDEC TAGM	UG/KG	440	U	360	U	750	U	370	U	350	U	1800	UJ	390	U
Anthracene	50000	NYSDEC TAGM	UG/KG	27	J	360	U	750	U	370	U	350	U	1800	UJ	390	U
Benzo(a)anthracene	224	NYSDEC TAGM	UG/KG	110	J	31	J	45	J	26	J	350	U	1800	UJ	390	U
Benzo(a)pyrene	61	NYSDEC TAGM	UG/KG	**99**	**J**	27	J	40	J	24	J	350	U	1800	UJ	22	J
Benzo(b)fluoranthene	1100	NYSDEC TAGM	UG/KG	100	J	31	J	49	J	33	J	350	U	1800	UJ	21	J
Benzo(g,h,i)perylene	50000	NYSDEC TAGM	UG/KG	62	J	360	U	750	U	19	J	350	U	1800	UJ	390	U
Benzo(k)fluoranthene	1100	NYSDEC TAGM	UG/KG	98	J	34	J	53	J	30	J	350	U	1800	UJ	22	J
Carbazole			UG/KG	22	J	360	U	750	U	370	U	350	U	1800	UJ	390	U
Chrysene	400	NYSDEC TAGM	UG/KG	130	J	49	J	72	J	44	J	16	J	1800	UJ	22	J

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-9
SEAD-16 Summary of Analytes Detected in Surface Soil

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS16-11		SS16-12		SS16-13		SS16-14		SS16-15		SS16-16		SS16-17	
			SAMP ID:	SS16-11-1		SS16-12-1		SS16-13-1		SS16-14-1		SS16-15-1		SS16-16-1		16040	
			QC CODE:	SA		SA		SA		SA		SA		SA		SA	
			STUDY ID:	ESI		ESI		ESI		ESI		ESI		ESI		RI ROUND1	
			TOP:	0		0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	10/20/93		10/20/93		10/20/93		10/20/93		10/20/93		10/20/93		8/19/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Di-n-butylphthalate	8100	NYSDEC TAGM	UG/KG	250	J	19	J	750	U	76	J	350	U	1800	UJ	390	U
Dibenz(a,h)anthracene	14	NYSDEC TAGM	UG/KG	440	U	360	U	750	U	370	U	350	U	1800	UJ	390	U
Dibenzofuran	6200	NYSDEC TAGM	UG/KG	440	U	360	U	750	U	370	U	350	U	1800	UJ	390	U
Diethylphthalate	7100	NYSDEC TAGM	UG/KG	440	U	360	U	750	U	370	U	350	U	1800	UJ	390	U
Fluoranthene	50000	NYSDEC TAGM	UG/KG	240	J	83	J	120	J	68	J	23	J	1800	UJ	37	J
Fluorene	50000	NYSDEC TAGM	UG/KG	440	U	360	U	750	U	370	U	350	U	1800	UJ	390	U
Indeno(1,2,3-cd)pyrene	3200	NYSDEC TAGM	UG/KG	30	J	360	U	750	U	370	U	350	U	1800	UJ	390	U
N-Nitrosodiphenylamine (1)			UG/KG	22	J	360	U	43	J	17	J	350	U	1800	UJ	390	U
Naphthalene	13000	NYSDEC TAGM	UG/KG	440	U	360	U	750	U	370	U	350	U	1800	UJ	390	U
Pentachlorophenol	1000	NYSDEC TAGM	UG/KG	1100	U	880	U	1800	U	890	U	860	U	4500	UJ	950	U
Phenanthrene	50000	NYSDEC TAGM	UG/KG	130	J	45	J	81	J	36	J	25	J	1800	UJ	19	J
Pyrene	50000	NYSDEC TAGM	UG/KG	200	J	66	J	97	J	54	J	19	J	1800	UJ	26	J
bis(2-Ethylhexyl)phthalate	50000	NYSDEC TAGM	UG/KG	540	J	360	U	320	J	370	J	350	U	1800	UJ	24	U
PESTICIDES/PCB																	
4,4'-DDD	2900	NYSDEC TAGM	UG/KG	4.4	U	3.6	U	3.7	U	7.3	U	3.5	U	7.4	U	3.9	U
4,4'-DDE	2100	NYSDEC TAGM	UG/KG	15	J	38		6		59		28	J	38		3.9	U
4,4'-DDT	2100	NYSDEC TAGM	UG/KG	6.3	J	5		2.6	J	19		2.1	J	89		3.9	U
Aldrin	41	NYSDEC TAGM	UG/KG	2.3	U	1.9	U	1.9	U	3.8	U	1.8	U	3.8	U	2	U
Aroclor-1254	1000	NYSDEC TAGM	UG/KG	44	U	36	U	37	U	73	U	35	U	74	U	39	U
Aroclor-1260	1000	NYSDEC TAGM	UG/KG	110		36	U	37	U	73	U	22	J	74	U	39	U
Dieldrin	44	NYSDEC TAGM	UG/KG	4.4	U	3.6	U	3.7	U	7.3	U	3.5	U	7.4	U	3.9	U
Endosulfan I	900	NYSDEC TAGM	UG/KG	2.3	U	1.4	J	1.9	U	3.8	U	0.96	J	3.8	U	2	U
Endosulfan II	900	NYSDEC TAGM	UG/KG	4.4	U	3.6	U	3.7	U	7.3	U	3.5	U	7.4	U	3.9	U
Endosulfan sulfate	1000	NYSDEC TAGM	UG/KG	4.4	U	3.6	U	3.7	U	7.3	U	3.5	U	7.4	U	3.9	U
Endrin	100	NYSDEC TAGM	UG/KG	4.4	U	3.6	U	3.7	U	7.3	U	3.5	U	7.4	U	3.9	U

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-9
SEAD-16 Summary of Analytes Detected in Surface Soil

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS16-11		SS16-12		SS16-13		SS16-14		SS16-15		SS16-16		SS16-17	
			SAMP ID:	SS16-11-1		SS16-12-1		SS16-13-1		SS16-14-1		SS16-15-1		SS16-16-1		16040	
			QC CODE:	SA		SA		SA		SA		SA		SA		SA	
			STUDY ID:	ESI		ESI		ESI		ESI		ESI		ESI		RI ROUND1	
			TOP:	0		0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	10/20/93		10/20/93		10/20/93		10/20/93		10/20/93		10/20/93		8/19/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Endrin aldehyde			UG/KG	6.5	J	3.6	U	3.7	U	7.3	U	3.5	U	7.4	U	3.9	U
Endrin ketone			UG/KG	4.4	U	3.6	U	3.7	U	7.3	U	3.5	U	7.4	U	3.9	U
Heptachlor	100	NYSDEC TAGM	UG/KG	2.3	U	1.9	U	1.9	U	3.8	U	1.8	U	3.8	U	2	U
Heptachlor epoxide	20	NYSDEC TAGM	UG/KG	2.3	U	1.6	J	2.1	J	3.8	U	1.8	U	3.8	U	2	U
Toxaphene			UG/KG	230	U	190	U	190	U	380	U	180	U	380	U	200	U
alpha-Chlordane			UG/KG	2.3	U	1.9	U	1.9	U	4.8		1.8	U	3.8	U	2	U
beta-BHC	200	NYSDEC TAGM	UG/KG	2.3	U	1.9	U	1.9	U	3.8	U	1.8	U	3.8	U	2	U
gamma-BHC (Lindane)	60	NYSDEC TAGM	UG/KG	2.3	U	1.9	U	1.9	U	3.8	U	1.8	U	3.8	U	2	U
gamma-Chlordane	540	NYSDEC TAGM	UG/KG	2.3	U	1.9	U	1.9	U	3.4	J	1.8	U	3.8	U	2	U
OTHER ANALYSES																	
Nitrate/Nitrite-Nitrogen			MG/KG	0.23		0.04		0.05		0.05		0.04		0.2		1.4	
Percent Moisture (PEST/PCB)																16	
Percent Moisture (SVOCs)																16	
Percent Moisture (VOCs)																19	
Percent Solids (Metals)																84	
Total Organic Carbon			MG/KG														
NITROAROMATICS																	
2,4-Dinitrotoluene			UG/KG	130	U	130	U	130	U	1200		130	U	150		74000	
2,6-Dinitrotoluene	1000	NYSDEC TAGM	UG/KG	130	U	130	U	130	U	130	U	130	U	130	U	2500	U
2-amino-4,6-Dinitrotoluene			UG/KG	130	U	130	U	130	U	130	U	130	U	130	U	2500	U
Tetryl			UG/KG	130	U	130	U	130	U	130	U	130	U	130	U	2500	U
METALS																	
Aluminum	14592.8	NYSDEC TAGM	MG/KG	**17200**		10400		14100		7680		7510		6310		10200	J
Antimony	3.59	NYSDEC TAGM	MG/KG	13.9	U	6.6	U	8.2	U	**8.4**		6.2	U	9	U	2.9	J
Arsenic	7.5	NYSDEC TAGM	MG/KG	**7.7**		5.2		6.8		**9.9**		4.8		3.8		4.7	J

Note: Shaded values exceed the NYSDEC TAGM.
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Table 4-9

SEAD-16 Summary of Analytes Detected in Surface Soil

SEAD-16 Remedial Investigation

Seneca Army Depot Activity

			LOC_ID:	SS16-11		SS16-12		SS16-13		SS16-14		SS16-15		SS16-16		SS16-17	
			SAMP ID:	SS16-11-1		SS16-12-1		SS16-13-1		SS16-14-1		SS16-15-1		SS16-16-1		16040	
			QC CODE:	SA		SA		SA		SA		SA		SA		SA	
			STUDY ID:	ESI		ESI		ESI		ESI		ESI		ESI		RI ROUND1	
			TOP:	0		0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	10/20/93		10/20/93		10/20/93		10/20/93		10/20/93		10/20/93		8/19/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Barium	300	NYSDEC TAGM	MG/KG	195		52		88.2		211		35.1		56.6		168	J
Beryllium	0.73	NYSDEC TAGM	MG/KG	**0.91**	**J**	0.46	J	0.59	J	0.41	J	0.34	J	0.37	J	0.24	
Cadmium	1	NYSDEC TAGM	MG/KG	0.87	U	0.41	U	0.51	U	0.61	J	0.39	U	0.56	U	0.45	
Calcium	101904	NYSDEC TAGM	MG/KG	9820		30300		28700		**178000**		26800		**135000**		7470	
Chromium	22.13	NYSDEC TAGM	MG/KG	**25.5**		19.2		**26.7**		14.4		15.6		14.1		16	
Cobalt	30	NYSDEC TAGM	MG/KG	16.7		10.6		13.7		8.2		8.1		10.4		9.3	
Copper	25	NYSDEC TAGM	MG/KG	**199**		**54.8**		**204**		**163**		**42.6**		**69.2**		**74.4**	**J**
Cyanide	0.3	NYSDEC TAGM	MG/KG	0.69	U	0.64	U	0.63	U	0.64	U	0.63	U	0.67	U	0.59	U
Iron	26626.7	NYSDEC TAGM	MG/KG	**30600**		22700		**30400**		16500		17500		11700		19700	J
Lead	21.86	NYSDEC TAGM	MG/KG	**616**		**195**		**460**		**720**		**210**		**643**		**304**	**J**
Magnesium	12221.8	NYSDEC TAGM	MG/KG	5200		5830		7350		5990		4770		**56000**		3520	
Manganese	669.38	NYSDEC TAGM	MG/KG	**706**	**J**	329	J	417	J	270	J	227	J	310	J	**948**	
Mercury	0.1	NYSDEC TAGM	MG/KG	**0.73**		**0.24**		**1**		0.07	J	0.05	J	0.04	J	**1.2**	**J**
Nickel	33.62	NYSDEC TAGM	MG/KG	**35.2**		**39.5**		**50.8**		29.4		30.5		28.5		22.7	J
Potassium	1761.48	NYSDEC TAGM	MG/KG	1600		1080		1320		1100		802		**2300**		1170	
Selenium	2	NYSDEC TAGM	MG/KG	0.24	UJ	0.25	J	0.21	J	0.41	J	0.22	UJ	0.21	UJ	0.59	
Silver	0.4	NYSDEC TAGM	MG/KG	1.8	U	0.84	U	1	U	0.93	U	0.79	U	1.1	U	0.26	
Sodium	103.74	NYSDEC TAGM	MG/KG	72.2	J	**108**	**J**	**125**	**J**	**176**	**J**	90.1	J	**240**	**J**	51.8	U
Thallium	0.28	NYSDEC TAGM	MG/KG	0.26	U	0.25	U	0.16	U	0.14	U	0.24	U	0.23	U	**1.7**	**J**
Vanadium	150	NYSDEC TAGM	MG/KG	28.8		15		21.1		13.4		10.8		61.9		20.1	J
Zinc	82.5	NYSDEC TAGM	MG/KG	**1270**		**89**		**128**		**104**		68.6		**93.8**		**107**	
HERBICIDES																	
2,4,5-T	1900	NYSDEC TAGM	UG/KG	6.7	U	5.5	U	5.7	U	8.3		5.4	U	5.6	U		
MCPP			UG/KG	6700	U	5500	U	5700	U	5600	U	5400	U	5600	U		

Note: Shaded values exceed the NYSDEC TAGM.
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Table 4-9
SEAD-16 Summary of Analytes Detected in Surface Soil

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS16-18		SS16-19		SS16-2		SS16-20		SS16-21		SS16-21	
			SAMP ID:	16041		16042		SS16-2-1		16043		16058		16059	
			QC CODE:	SA		SA		SA		SA		SA		DU	
			STUDY ID:	RI ROUND1		RI ROUND1		ESI		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/19/96		8/19/96		10/20/93		8/19/96		8/21/96		8/21/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
VOLATILE ORGANICS															
1,1,2,2-Tetrachloroethane	600	NYSDEC TAGM	UG/KG	12	U	10	UJ	12	U	11	UJ	10	UJ	10	UJ
Acetone	200	NYSDEC TAGM	UG/KG	8	U	10	UJ	12	U	11	UJ	10	U	10	U
Benzene	60	NYSDEC TAGM	UG/KG	12	U	10	UJ	12	U	2	J	10	U	10	UJ
Carbon Disulfide	2700	NYSDEC TAGM	UG/KG	12	U	10	UJ	1	J	11	UJ	10	U	10	U
Chloroform	300	NYSDEC TAGM	UG/KG	6	U	5	UJ	12	U	5	UJ	5	U	5	U
Methylene Chloride	100	NYSDEC TAGM	UG/KG	12	U	10	UJ	12	U	11	UJ	10	U	10	U
Toluene	1500	NYSDEC TAGM	UG/KG	12	U	2	J	12	U	3	J	10	UJ	2	J
Xylene (total)	1200	NYSDEC TAGM	UG/KG	12	U	10	UJ	12	U	11	UJ	10	UJ	10	UJ
SEMIVOLATILE ORGANICS															
2,4-Dinitrotoluene			UG/KG	420	U	340	U	760		58	J	15000		19000	
2,6-Dinitrotoluene	1000	NYSDEC TAGM	UG/KG	420	U	340	U	410	U	350	U	**1200**	**J**	**1600**	**J**
2-Methylnaphthalene	36400	NYSDEC TAGM	UG/KG	420	U	340	U	350	J	350	U	2300	U	2900	U
3,3'-Dichlorobenzidine			UG/KG	420	U	340	U	410	U	350	U	2300	U	2900	U
3-Nitroaniline	500	NYSDEC TAGM	UG/KG	1000	U	820	U	1000	U	850	U	5600	U	7100	U
Acenaphthene	50000	NYSDEC TAGM	UG/KG	420	U	340	U	410	U	350	U	2300	U	2900	U
Acenaphthylene	41000	NYSDEC TAGM	UG/KG	420	U	340	U	65	J	350	U	2300	U	2900	U
Anthracene	50000	NYSDEC TAGM	UG/KG	420	U	340	U	55	J	350	U	2300	U	2900	U
Benzo(a)anthracene	224	NYSDEC TAGM	UG/KG	420	U	340	U	**260**	**J**	26	J	2300	U	2900	U
Benzo(a)pyrene	61	NYSDEC TAGM	UG/KG	420	U	340	U	**300**	**J**	34	J	2300	U	2900	U
Benzo(b)fluoranthene	1100	NYSDEC TAGM	UG/KG	420	U	20	J	500		32	J	2300	U	2900	U
Benzo(g,h,i)perylene	50000	NYSDEC TAGM	UG/KG	420	U	340	U	130	J	350	U	2300	U	2900	U
Benzo(k)fluoranthene	1100	NYSDEC TAGM	UG/KG	420	U	16	J	310	J	32	J	2300	U	2900	U
Carbazole			UG/KG	420	U	340	U	48	J	350	U	2300	U	2900	U
Chrysene	400	NYSDEC TAGM	UG/KG	19	J	24	J	**470**		37	J	2300	U	2900	U

Note: Shaded values exceed the NYSDEC TAGM.
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Table 4-9
SEAD-16 Summary of Analytes Detected in Surface Soil

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS16-18		SS16-19		SS16-2		SS16-20		SS16-21		SS16-21	
			SAMP ID:	16041		16042		SS16-2-1		16043		16058		16059	
			QC CODE:	SA		SA		SA		SA		SA		DU	
			STUDY ID:	RI ROUND1		RI ROUND1		ESI		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/19/96		8/19/96		10/20/93		8/19/96		8/21/96		8/21/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Di-n-butylphthalate	8100	NYSDEC TAGM	UG/KG	420	U	340	U	710		350	U	2300	U	2300	U
Dibenz(a,h)anthracene	14	NYSDEC TAGM	UG/KG	420	U	340	U	410	U	32	U	2300	U	2900	U
Dibenzofuran	6200	NYSDEC TAGM	UG/KG	420	U	340	U	100	J	350	U	2300	U	2900	U
Diethylphthalate	7100	NYSDEC TAGM	UG/KG	19	J	16	J	410	U	350	U	2300	U	2900	U
Fluoranthene	50000	NYSDEC TAGM	UG/KG	28	J	39	J	580		43	J	2300	U	2900	U
Fluorene	50000	NYSDEC TAGM	UG/KG	420	U	340	U	410	U	350	U	2300	U	2900	U
Indeno(1,2,3-cd)pyrene	3200	NYSDEC TAGM	UG/KG	420	U	340	U	30	J	350	U	2300	U	2900	U
N-Nitrosodiphenylamine (1)			UG/KG	420	U	340	U	150	J	350	U	1600	J	1700	J
Naphthalene	13000	NYSDEC TAGM	UG/KG	420	U	340	U	230	J	350	U	2300	U	2900	U
Pentachlorophenol	1000	NYSDEC TAGM	UG/KG	1000	U	820	U	1000	U	850	U	5600	U	7100	U
Phenanthrene	50000	NYSDEC TAGM	UG/KG	420	U	29	J	420		27	J	2300	U	2900	U
Pyrene	50000	NYSDEC TAGM	UG/KG	22	J	30	J	520		41	J	2300	U	2900	U
bis(2-Ethylhexyl)phthalate	50000	NYSDEC TAGM	UG/KG	26	U	84	U	410	U	200	U	2300	U	2800	U
PESTICIDES/PCB															
4,4'-DDD	2900	NYSDEC TAGM	UG/KG	4.2	U	3.4	U	4.1	UR	3.5	U	3.5	R	2	U
4,4'-DDE	2100	NYSDEC TAGM	UG/KG	4.2	U	14		9.4	J	37		34	J	50	
4,4'-DDT	2100	NYSDEC TAGM	UG/KG	4.2	U	1.8	J	8.1	J	6.7		22	J	32	J
Aldrin	41	NYSDEC TAGM	UG/KG	2.2	U	1.7	U	2.1	UR	1.8	U	1.8	R	1.8	R
Aroclor-1254	1000	NYSDEC TAGM	UG/KG	42	U	34	U	41	UR	35	U	35	R	35	R
Aroclor-1260	1000	NYSDEC TAGM	UG/KG	42	U	34	U	41	UR	35	U	35	R	35	R
Dieldrin	44	NYSDEC TAGM	UG/KG	4.2	U	3.4	U	4.1	UR	3.5	U	3.5	R	3.5	R
Endosulfan I	900	NYSDEC TAGM	UG/KG	2.2	U	2	J	3.4	J	1.8	U	1.8	J	2.1	J
Endosulfan II	900	NYSDEC TAGM	UG/KG	4.2	U	3.4	U	4.1	UR	3.5	U	3.5	R	3.5	R
Endosulfan sulfate	1000	NYSDEC TAGM	UG/KG	4.2	U	3.4	U	4.1	UR	3.5	U	3.5	R	3.5	R
Endrin	100	NYSDEC TAGM	UG/KG	4.2	U	3.4	U	4.1	UR	3.5	U	3.5	R	2.1	R

Table 4-9
SEAD-16 Summary of Analytes Detected in Surface Soil

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS16-18		SS16-19		SS16-2		SS16-20		SS16-21		SS16-21	
			SAMP ID:	16041		16042		SS16-2-1		16043		16058		16059	
			QC CODE:	SA		SA		SA		SA		SA		DU	
			STUDY ID:	RI ROUND1		RI ROUND1		ESI		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/19/96		8/19/96		10/20/93		8/19/96		8/21/96		8/21/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Endrin aldehyde			UG/KG	4.2	U	3.4	U	4.1	UR	3.5	U	3.5	J	1.9	U
Endrin ketone			UG/KG	4.2	U	3.4	U	4.1	UR	3.5	U	3.5	R	3.5	R
Heptachlor	100	NYSDEC TAGM	UG/KG	2.2	U	1.7	U	2.1	UR	1.8	U	1.8	J	1.8	R
Heptachlor epoxide	20	NYSDEC TAGM	UG/KG	2.2	U	1.7	U	2.1	UR	1.8	U	1.8	R	1.8	R
Toxaphene			UG/KG	220	U	170	U	210	UR	180	U	180	J	180	R
alpha-Chlordane			UG/KG	2.2	U	1.7	U	2.1	UR	1.8	U	1.3	J	1.2	U
beta-BHC	200	NYSDEC TAGM	UG/KG	2.2	U	1.7	U	2.1	UR	1.8	U	1.8	R	1.8	R
gamma-BHC (Lindane)	60	NYSDEC TAGM	UG/KG	2.2	U	1.7	U	2.1	UR	1.8	U	1.8	R	1.8	R
gamma-Chlordane	540	NYSDEC TAGM	UG/KG	2.2	U	1.7	U	2.1	UR	1.8	U	1.8	R	1.3	J
OTHER ANALYSES															
Nitrate/Nitrite-Nitrogen			MG/KG	0.49		0.04		0.9		0.11		0.29		0.34	
Percent Moisture (PEST/PCB)				21		2				6		5		6	
Percent Moisture (SVOCs)				21		2				6		5		6	
Percent Moisture (VOCs)				17		4				6		5		4	
Percent Solids (Metals)				79.3		97.7				94		94.6		94.5	
Total Organic Carbon			MG/KG									11000			
NITROAROMATICS															
2,4-Dinitrotoluene			UG/KG	120	U	220		500		310		7300		7700	
2,6-Dinitrotoluene	1000	NYSDEC TAGM	UG/KG	120	U	120	U	130	U	120		250	U	250	U
2-amino-4,6-Dinitrotoluene			UG/KG	120	U	120	U	130	U	120	U	250	U	250	U
Tetryl			UG/KG	120	U	120	U	130	U	120	U	250	U	250	U
METALS															
Aluminum	14592.8	NYSDEC TAGM	MG/KG	13600	J	9670	J	6340		14100	J	12200	J	12900	J
Antimony	3.59	NYSDEC TAGM	MG/KG	2.5	J	3.5	J	**55.6**		**9.9**	**J**	**20.8**	**J**	**19.2**	**J**
Arsenic	7.5	NYSDEC TAGM	MG/KG	4.1	J	4.5	J	**16.6**		5.2	J	6.5		7.2	

Note: Shaded values exceed the NYSDEC TAGM.
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Table 4-9
SEAD-16 Summary of Analytes Detected in Surface Soil

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS16-18		SS16-19		SS16-2		SS16-20		SS16-21		SS16-21	
			SAMP ID:	16041		16042		SS16-2-1		16043		16058		16059	
			QC CODE:	SA		SA		SA		SA		SA		DU	
			STUDY ID:	RI ROUND1		RI ROUND1		ESI		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/19/96		8/19/96		10/20/93		8/19/96		8/21/96		8/21/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Barium	300	NYSDEC TAGM	MG/KG	148	J	124	J	**1200**		175	J	**442**	**J**	**676**	**J**
Beryllium	0.73	NYSDEC TAGM	MG/KG	**0.75**		0.37		0.42	J	0.52		0.46		0.52	
Cadmium	1	NYSDEC TAGM	MG/KG	0.25		0.36		1.6	R	0.49		0.69		0.87	
Calcium	101904	NYSDEC TAGM	MG/KG	5200		**113000**		11700		36300		34900		40200	
Chromium	22.13	NYSDEC TAGM	MG/KG	19.9		20.4		16.5		**29.1**		**40.3**		**38**	
Cobalt	30	NYSDEC TAGM	MG/KG	7.9		12.7	J	6.7	J	16.1	J	12.7		12.9	
Copper	25	NYSDEC TAGM	MG/KG	**60.1**	**J**	**99.4**	**J**	**911**		**207**	**J**	**379**		**536**	
Cyanide	0.3	NYSDEC TAGM	MG/KG	0.53	U	0.51	U	0.74	U	0.49	U	0.52	U	0.5	U
Iron	26626.7	NYSDEC TAGM	MG/KG	22700	J	21900	J	25900		**30600**	**J**	**27100**	**J**	**28700**	**J**
Lead	21.86	NYSDEC TAGM	MG/KG	**187**	**J**	**669**	**J**	**3780**		**1370**	**J**	**2030**		**2640**	
Magnesium	12221.8	NYSDEC TAGM	MG/KG	3190		10100		4400		8330		8560		8600	
Manganese	669.38	NYSDEC TAGM	MG/KG	353		413		178	J	417		381		373	
Mercury	0.1	NYSDEC TAGM	MG/KG	**0.77**	**J**	0.04	U	**4**		**0.13**	**J**	**0.26**		**0.3**	
Nickel	33.62	NYSDEC TAGM	MG/KG	20.3	J	**38.8**	**J**	21.7		**55.6**	**J**	**45.7**		**49.8**	
Potassium	1761.48	NYSDEC TAGM	MG/KG	1150		**1840**		673	J	**2020**		1240		1560	
Selenium	2	NYSDEC TAGM	MG/KG	0.93		0.47		0.4	J	0.46	U	1.2		0.81	
Silver	0.4	NYSDEC TAGM	MG/KG	0.32	U	0.31		1.5	U	0.28		0.21	U	0.25	U
Sodium	103.74	NYSDEC TAGM	MG/KG	66.2	U	**128**		**121**	**J**	**107**		101		102	
Thallium	0.28	NYSDEC TAGM	MG/KG	**1.1**	**J**	**0.74**	**J**	0.19	U	**0.92**	**J**	**0.8**	**J**	**1**	**J**
Vanadium	150	NYSDEC TAGM	MG/KG	24.5	J	16.5	J	14.5		21.5	J	17.1		18.6	
Zinc	82.5	NYSDEC TAGM	MG/KG	**87.5**		**117**		**478**		**174**		**246**		**307**	
HERBICIDES															
2,4,5-T	1900	NYSDEC TAGM	UG/KG					6.3	U						
MCPP			UG/KG					6300	U						

Note: Shaded values exceed the NYSDEC TAGM.
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Table 4-9
SEAD-16 Summary of Analytes Detected in Surface Soil

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS16-22		SS16-23		SS16-24		SS16-25		SS16-26		SS16-27	
			SAMP ID:	16049		16051		16060		16050		16046		16047	
			QC CODE:	SA		SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/20/96		8/20/96		8/21/96		8/20/96		8/20/96		8/20/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
VOLATILE ORGANICS															
1,1,2,2-Tetrachloroethane	600	NYSDEC TAGM	UG/KG	11	UJ	12	U	10	UJ	11	UJ	11	U	11	U
Acetone	200	NYSDEC TAGM	UG/KG	11	U	12	U	10	UJ	11	UJ	5	U	11	U
Benzene	60	NYSDEC TAGM	UG/KG	11	U	12	U	2	J	11	UJ	11	U	11	U
Carbon Disulfide	2700	NYSDEC TAGM	UG/KG	11	U	12	U	10	UJ	11	UJ	11	U	11	U
Chloroform	300	NYSDEC TAGM	UG/KG	6	U	6	U	5	UJ	2	J	5	U	5	U
Methylene Chloride	100	NYSDEC TAGM	UG/KG	11	U	12	U	10	UJ	11	UJ	11	U	11	U
Toluene	1500	NYSDEC TAGM	UG/KG	11	UJ	12	U	4	J	2	J	1	J	3	J
Xylene (total)	1200	NYSDEC TAGM	UG/KG	11	UJ	12	U	10	UJ	11	UJ	11	U	11	U
SEMIVOLATILE ORGANICS															
2,4-Dinitrotoluene			UG/KG	95	J	380	U	1800		39	J	870		85000	
2,6-Dinitrotoluene	1000	NYSDEC TAGM	UG/KG	360	U	380	U	160	J	340	U	350	U	**8000**	**J**
2-Methylnaphthalene	36400	NYSDEC TAGM	UG/KG	19	J	380	U	76	J	340	U	27	J	14000	U
3,3'-Dichlorobenzidine			UG/KG	360	U	380	U	340	U	340	U	350	U	14000	U
3-Nitroaniline	500	NYSDEC TAGM	UG/KG	870	U	920	U	830	U	830	U	850	U	35000	U
Acenaphthene	50000	NYSDEC TAGM	UG/KG	360	U	380	U	37	J	340	U	64	J	14000	U
Acenaphthylene	41000	NYSDEC TAGM	UG/KG	19	J	380	U	340	U	340	U	22	J	14000	U
Anthracene	50000	NYSDEC TAGM	UG/KG	32	J	380	U	44	J	340	U	120	J	14000	U
Benzo(a)anthracene	224	NYSDEC TAGM	UG/KG	190	J	380	U	340	U	26	J	**500**		**1300**	**J**
Benzo(a)pyrene	61	NYSDEC TAGM	UG/KG	**250**	**J**	380	U	340	U	30	J	**520**		**1500**	**J**
Benzo(b)fluoranthene	1100	NYSDEC TAGM	UG/KG	420		380	U	480		28	J	810		**1800**	**J**
Benzo(g,h,i)perylene	50000	NYSDEC TAGM	UG/KG	210	U	380	U	340	U	24	J	440	U	14000	U
Benzo(k)fluoranthene	1100	NYSDEC TAGM	UG/KG	290	J	380	U	340	U	33	J	600		**1500**	**J**
Carbazole			UG/KG	26	J	380	U	41	J	340	U	110	J	14000	U
Chrysene	400	NYSDEC TAGM	UG/KG	370		380	U	340	U	40	J	**720**		**1600**	**J**

Note: Shaded values exceed the NYSDEC TAGM.
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Table 4-9
SEAD-16 Summary of Analytes Detected in Surface Soil

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS16-22		SS16-23		SS16-24		SS16-25		SS16-26		SS16-27	
			SAMP ID:	16049		16051		16060		16050		16046		16047	
			QC CODE:	SA		SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/20/96		8/20/96		8/21/96		8/20/96		8/20/96		8/20/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Di-n-butylphthalate	8100	NYSDEC TAGM	UG/KG	32	J	380	U	340	U	340	U	430		**16000**	
Dibenz(a,h)anthracene	14	NYSDEC TAGM	UG/KG	67	U	380	U	**38**	**J**	340	U	100	U	680	U
Dibenzofuran	6200	NYSDEC TAGM	UG/KG	21	J	380	U	110	J	340	U	33	J	14000	U
Diethylphthalate	7100	NYSDEC TAGM	UG/KG	360	U	380	U	340	U	340	U	350	U	14000	U
Fluoranthene	50000	NYSDEC TAGM	UG/KG	420		380	U	520		56	J	1200		3100	J
Fluorene	50000	NYSDEC TAGM	UG/KG	360	U	380	U	24	J	340	U	67	J	14000	U
Indeno(1,2,3-cd)pyrene	3200	NYSDEC TAGM	UG/KG	210	U	380	U	340	U	22	J	440	U	14000	U
N-Nitrosodiphenylamine (1)			UG/KG	360	U	380	U	310	J	340	U	950		25000	
Naphthalene	13000	NYSDEC TAGM	UG/KG	360	U	380	U	24	J	340	U	18	J	14000	U
Pentachlorophenol	1000	NYSDEC TAGM	UG/KG	870	U	920	U	830	U	830	U	850	U	35000	U
Phenanthrene	50000	NYSDEC TAGM	UG/KG	160	J	380	U	340	U	25	J	770		1800	J
Pyrene	50000	NYSDEC TAGM	UG/KG	360		380	U	350		51	J	1000		2200	J
bis(2-Ethylhexyl)phthalate	50000	NYSDEC TAGM	UG/KG	360	U	380	U	340	U	24	J	1200		14000	U
PESTICIDES/PCB															
4,4'-DDD	2900	NYSDEC TAGM	UG/KG	5.4	J	3.8	U	8.9	J	3.4	U	23	J	17	J
4,4'-DDE	2100	NYSDEC TAGM	UG/KG	73	J	21		110	J	20		210	J	190	J
4,4'-DDT	2100	NYSDEC TAGM	UG/KG	18	J	22		24	J	5.2		340	J	320	J
Aldrin	41	NYSDEC TAGM	UG/KG	1.8	U	2	U	1.8	R	1.8	U	5	J	1.8	U
Aroclor-1254	1000	NYSDEC TAGM	UG/KG	36	U	38	U	1100	J	34	U	180	U	280	
Aroclor-1260	1000	NYSDEC TAGM	UG/KG	55	J	38	U	160	J	34	U	340	J	310	J
Dieldrin	44	NYSDEC TAGM	UG/KG	3.6	U	3.8	U	2.9	U	2	UJ	18	U	4.3	J
Endosulfan I	900	NYSDEC TAGM	UG/KG	5.9	J	2.3	J	13	J	1.6	UJ	9	U	21	J
Endosulfan II	900	NYSDEC TAGM	UG/KG	3.6	U	3.8	U	3.4	R	3.4	U	9.9	U	2.3	J
Endosulfan sulfate	1000	NYSDEC TAGM	UG/KG	3.6	U	3.8	U	2.8	U	3.4	U	18	U	2.1	J
Endrin	100	NYSDEC TAGM	UG/KG	2.2	J	3.8	U	9.1	J	3.1	UJ	17	U	6.4	J

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-9
SEAD-16 Summary of Analytes Detected in Surface Soil

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS16-22		SS16-23		SS16-24		SS16-25		SS16-26		SS16-27	
			SAMP ID:	16049		16051		16060		16050		16046		16047	
			QC CODE:	SA		SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/20/96		8/20/96		8/21/96		8/20/96		8/20/96		8/20/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Endrin aldehyde			UG/KG	3.4	U	3.8	U	4.9	J	3.4	U	15	U	14	J
Endrin ketone			UG/KG	3.6	U	3.8	U	3.4	R	3.4	U	18	U	3.6	J
Heptachlor	100	NYSDEC TAGM	UG/KG	1.8	U	2	U	1.8	R	1.8	U	9	U	1.8	U
Heptachlor epoxide	20	NYSDEC TAGM	UG/KG	1.8	U	2	U	6.7	J	1.8	U	9	U	1.6	J
Toxaphene			UG/KG	180	U	200	U	180	R	180	U	900	U	180	U
alpha-Chlordane			UG/KG	5.7		2	U	14	J	1.8	U	170	J	11	J
beta-BHC	200	NYSDEC TAGM	UG/KG	1.8	U	2	U	1.8	R	1.8	U	9	U	2.3	
gamma-BHC (Lindane)	60	NYSDEC TAGM	UG/KG	2.3	J	2	U	1.8	R	1.8	U	9	U	1.8	U
gamma-Chlordane	540	NYSDEC TAGM	UG/KG	2.5	J	2	U	11	J	1.8	U	200	J	6.4	
OTHER ANALYSES															
Nitrate/Nitrite-Nitrogen			MG/KG	0.03		0.08		0.04		0.06		0.39		0.11	
Percent Moisture (PEST/PCB)				8		13		4		4		6		8	
Percent Moisture (SVOCs)				8		13		4		4		6		8	
Percent Moisture (VOCs)				13		18		4		9		9		9	
Percent Solids (Metals)				92		87.4		95.8		95.8		93.5		91.9	
Total Organic Carbon			MG/KG											56400	
NITROAROMATICS															
2,4-Dinitrotoluene			UG/KG	160	J	120	U	450	J	200	J	490		7500	J
2,6-Dinitrotoluene	1000	NYSDEC TAGM	UG/KG	120	U	120	U	120	U	120	U	120	U	320	J
2-amino-4,6-Dinitrotoluene			UG/KG	120	U	120	U	120	U	120	U	120	U	250	U
Tetryl			UG/KG	120	U	120	U	120	U	120	U	120	U	250	U
METALS															
Aluminum	14592.8	NYSDEC TAGM	MG/KG	12200	J	10400	J	11100	J	14100	J	6370	J	11300	J
Antimony	3.59	NYSDEC TAGM	MG/KG	**20.3**	**J**	**10.4**	**J**	**7.1**	**J**	3.1	J	**1930**	**J**	**122**	**J**
Arsenic	7.5	NYSDEC TAGM	MG/KG	6.2	J	**7.9**		6.1		4	J	**23**	**J**	**32.2**	**J**

Note: Shaded values exceed the NYSDEC TAGM.
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Table 4-9
SEAD-16 Summary of Analytes Detected in Surface Soil

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS16-22		SS16-23		SS16-24		SS16-25		SS16-26		SS16-27	
			SAMP ID:	16049		16051		16060		16050		16046		16047	
			QC CODE:	SA		SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/20/96		8/20/96		8/21/96		8/20/96		8/20/96		8/20/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Barium	300	NYSDEC TAGM	MG/KG	169	J	263	J	148	J	121	J	**9340**	**J**	**5190**	**J**
Beryllium	0.73	NYSDEC TAGM	MG/KG	0.46		0.49		0.46		0.53		0.02	U	0.13	
Cadmium	1	NYSDEC TAGM	MG/KG	**1.3**		0.76		**1.2**		0.25		**7.1**		**16.6**	
Calcium	101904	NYSDEC TAGM	MG/KG	56900		25400		50600		39200		68400		99700	
Chromium	22.13	NYSDEC TAGM	MG/KG	**31**		20.4		**26.6**		**28.4**		**47.5**		**43.7**	
Cobalt	30	NYSDEC TAGM	MG/KG	12.7	J	9		13.5		17.8	J	8.8		9.6	
Copper	25	NYSDEC TAGM	MG/KG	**357**	**J**	**291**		**324**		**86.6**	**J**	**37900**	**J**	**3200**	**J**
Cyanide	0.3	NYSDEC TAGM	MG/KG	0.5	U	0.56	U	0.46	U	0.44	U	0.53	U	0.54	U
Iron	26626.7	NYSDEC TAGM	MG/KG	25700	J	20500		**27600**	**J**	**28800**	**J**	17900	J	20500	J
Lead	21.86	NYSDEC TAGM	MG/KG	**2920**	**J**	**1360**		**1450**		**439**	**J**	**140000**	**J**	**12600**	**J**
Magnesium	12221.8	NYSDEC TAGM	MG/KG	8610		7510		8200		8170		9100		**22300**	
Manganese	669.38	NYSDEC TAGM	MG/KG	414		350		432		465		367		581	
Mercury	0.1	NYSDEC TAGM	MG/KG	**1.7**	**J**	**0.93**		**0.27**		**0.4**	**J**	**1.6**	**J**	**2.6**	**J**
Nickel	33.62	NYSDEC TAGM	MG/KG	**44.1**	**J**	25		**48**		**53.5**	**J**	30.2	J	31.3	J
Potassium	1761.48	NYSDEC TAGM	MG/KG	**2200**		1080		1540		**2280**		599		1510	
Selenium	2	NYSDEC TAGM	MG/KG	0.54		0.73	U	0.57	U	0.65		0.59		0.52	U
Silver	0.4	NYSDEC TAGM	MG/KG	0.33		0.27		0.28		0.32		**11.1**		**1.9**	
Sodium	103.74	NYSDEC TAGM	MG/KG	89.1		**138**		**120**		61.3		**1830**		**342**	
Thallium	0.28	NYSDEC TAGM	MG/KG	**0.9**	**J**	0.85	U	0.66	U	0.82	U	**16.6**	**J**	**1.2**	**J**
Vanadium	150	NYSDEC TAGM	MG/KG	26.7	J	20.1		21.3		22.5	J	15.5	J	23.6	J
Zinc	82.5	NYSDEC TAGM	MG/KG	**299**		**411**		**327**		**113**		**14600**		**2120**	
HERBICIDES															
2,4,5-T	1900	NYSDEC TAGM	UG/KG												
MCPP			UG/KG												

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-9
SEAD-16 Summary of Analytes Detected in Surface Soil

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS16-28		SS16-29		SS16-3		SS16-30		SS16-31		SS16-32	
			SAMP ID:	16044		16045		SS16-3-1		16048		16062		16052	
			QC CODE:	SA		SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		ESI		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/19/96		8/19/96		10/22/93		8/20/96		8/21/96		8/20/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
VOLATILE ORGANICS															
1,1,2,2-Tetrachloroethane	600	NYSDEC TAGM	UG/KG	10	U	10	UJ	11	U	11	UJ	11	U	10	U
Acetone	200	NYSDEC TAGM	UG/KG	10	U	11	UJ	11	U	11	U	11	U	10	U
Benzene	60	NYSDEC TAGM	UG/KG	10	U	2	J	11	U	11	U	11	U	10	U
Carbon Disulfide	2700	NYSDEC TAGM	UG/KG	10	U	10	UJ	11	U	11	U	11	U	10	U
Chloroform	300	NYSDEC TAGM	UG/KG	5	U	5	UJ	11	U	6	U	5	U	5	U
Methylene Chloride	100	NYSDEC TAGM	UG/KG	10	U	10	UJ	11	U	11	U	11	U	10	U
Toluene	1500	NYSDEC TAGM	UG/KG	10	U	4	J	4	J	11	UJ	11	U	10	U
Xylene (total)	1200	NYSDEC TAGM	UG/KG	10	U	10	UJ	11	U	11	UJ	11	U	10	U
SEMIVOLATILE ORGANICS															
2,4-Dinitrotoluene			UG/KG	500		1800		7100		9400		91000	UJ	340	U
2,6-Dinitrotoluene	1000	NYSDEC TAGM	UG/KG	51	J	150	J	310	J	680	J	91000	UJ	350	U
2-Methylnaphthalene	36400	NYSDEC TAGM	UG/KG	350	U	340	U	510	J	1300	U	19000	J	98	J
3,3'-Dichlorobenzidine			UG/KG	350	U	340	U	1100	U	1300	U	91000	UJ	350	U
3-Nitroaniline	500	NYSDEC TAGM	UG/KG	840	U	820	U	2700	U	3100	U	220000	UJ	850	U
Acenaphthene	50000	NYSDEC TAGM	UG/KG	350	U	340	U	1100	U	1300	U	**72000**	**J**	30	J
Acenaphthylene	41000	NYSDEC TAGM	UG/KG	350	U	340	U	1100	U	1300	U	91000	U	140	J
Anthracene	50000	NYSDEC TAGM	UG/KG	350	U	340	U	1100	U	1300	U	**120000**	**J**	120	J
Benzo(a)anthracene	224	NYSDEC TAGM	UG/KG	42	J	340	U	110	J	1300	U	**220000**	**J**	**760**	
Benzo(a)pyrene	61	NYSDEC TAGM	UG/KG	**61**	**J**	17	J	**120**	**J**	1300	U	**200000**	**J**	**1800**	
Benzo(b)fluoranthene	1100	NYSDEC TAGM	UG/KG	84	J	17	J	170	J	1300	U	**200000**	**J**	**2500**	
Benzo(g,h,i)perylene	50000	NYSDEC TAGM	UG/KG	350	U	340	U	1100	U	1300	U	**100000**	**J**	1100	
Benzo(k)fluoranthene	1100	NYSDEC TAGM	UG/KG	65	J	340	U	97	J	1300	U	**170000**	**J**	350	U
Carbazole			UG/KG	350	U	340	U	1100	U	1300	U	89000	J	34	J
Chrysene	400	NYSDEC TAGM	UG/KG	70	J	17	J	200	J	170	J	**220000**	**J**	**950**	

Note: Shaded values exceed the NYSDEC TAGM.
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Table 4-9
SEAD-16 Summary of Analytes Detected in Surface Soil

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS16-28		SS16-29		SS16-3		SS16-30		SS16-31		SS16-32	
			SAMP ID:	16044		16045		SS16-3-1		16048		16062		16052	
			QC CODE:	SA		SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		ESI		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/19/96		8/19/96		10/22/93		8/20/96		8/21/96		8/20/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Di-n-butylphthalate	8100	NYSDEC TAGM	UG/KG	350	U	150	J	1200		1500		91000	UJ	350	U
Dibenz(a,h)anthracene	14	NYSDEC TAGM	UG/KG	28	U	340	U	1100	U	1300	U	**49000**	**J**	**520**	
Dibenzofuran	6200	NYSDEC TAGM	UG/KG	350	U	340	U	110	J	1300	U	**50000**	**J**	350	U
Diethylphthalate	7100	NYSDEC TAGM	UG/KG	350	U	340	U	1100	U	1300	U	91000	UJ	350	U
Fluoranthene	50000	NYSDEC TAGM	UG/KG	94	J	21	J	200	J	180	J	**530000**	**J**	700	
Fluorene	50000	NYSDEC TAGM	UG/KG	350	U	340	U	1100	U	1300	U	**78000**	**J**	350	U
Indeno(1,2,3-cd)pyrene	3200	NYSDEC TAGM	UG/KG	350	U	340	U	1100	U	1300	U	**100000**	**J**	990	
N-Nitrosodiphenylamine (1)			UG/KG	100	J	110	J	1400		780	J	91000	UJ	180	J
Naphthalene	13000	NYSDEC TAGM	UG/KG	350	U	340	U	320	J	1300	U	**66000**	**J**	55	J
Pentachlorophenol	1000	NYSDEC TAGM	UG/KG	840	U	820	U	2700	U	3100	U	220000	UJ	850	U
Phenanthrene	50000	NYSDEC TAGM	UG/KG	37	J	340	U	360	J	99	J	**490000**	**J**	350	U
Pyrene	50000	NYSDEC TAGM	UG/KG	81	J	23	J	200	J	220	J	**360000**	**J**	1200	
bis(2-Ethylhexyl)phthalate	50000	NYSDEC TAGM	UG/KG	66	U	17	U	390	J	1300	U	91000	UJ	350	U
PESTICIDES/PCB															
4,4'-DDD	2900	NYSDEC TAGM	UG/KG	1.8	J	3.4	U	3.9	UJ	2.65		3.2	U	3.5	U
4,4'-DDE	2100	NYSDEC TAGM	UG/KG	20		5.7		32	J	6.12		12		11	
4,4'-DDT	2100	NYSDEC TAGM	UG/KG	2.7	J	3.4	U	18	J	21.5	J	43		9.9	
Aldrin	41	NYSDEC TAGM	UG/KG	1.8	U	1.8	U	2.8	J	2	U	1.9	U	1.8	U
Aroclor-1254	1000	NYSDEC TAGM	UG/KG	34	U	34	U	39	UJ	38	U	36	U	35	U
Aroclor-1260	1000	NYSDEC TAGM	UG/KG	34	U	34	U	110	J	80		36	U	35	U
Dieldrin	44	NYSDEC TAGM	UG/KG	3.4	U	3.4	U	3.9	UJ	3.8	U	3.6	U	3.5	U
Endosulfan I	900	NYSDEC TAGM	UG/KG	2.2	J	1.8	U	2	UJ	10.5	J	7.7		33	J
Endosulfan II	900	NYSDEC TAGM	UG/KG	3.4	U	3.4	U	4.6	J	3.8	U	3.6	U	5	J
Endosulfan sulfate	1000	NYSDEC TAGM	UG/KG	3.4	U	3.4	U	3.9	UJ	3.8	U	3.6	U	3.5	U
Endrin	100	NYSDEC TAGM	UG/KG	3.4	U	3.4	U	3.9	UJ	3.8	U	3.6	U	9.9	

Note: Shaded values exceed the NYSDEC TAGM.
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Table 4-9
SEAD-16 Summary of Analytes Detected in Surface Soil

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS16-28		SS16-29		SS16-3		SS16-30		SS16-31		SS16-32	
			SAMP ID:	16044		16045		SS16-3-1		16048		16062		16052	
			QC CODE:	SA		SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		ESI		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/19/96		8/19/96		10/22/93		8/20/96		8/21/96		8/20/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Endrin aldehyde			UG/KG	3.4	U	3.4	U	3.9	UJ	4.15	J	3.6	U	3.7	R
Endrin ketone			UG/KG	3.4	U	3.4	U	3.3	J	3.8	U	1.7	J	3.4	U
Heptachlor	100	NYSDEC TAGM	UG/KG	1.8	U	1.8	U	2	UJ	2	U	1.9	U	1.8	U
Heptachlor epoxide	20	NYSDEC TAGM	UG/KG	1	J	1.8	U	2	UJ	2	U	1.9	U	1.5	R
Toxaphene			UG/KG	180	U	180	U	200	UJ	200	U	190	U	180	U
alpha-Chlordane			UG/KG	4.6		1.8	U	4.7	J	10.1		5.1	J	8.6	J
beta-BHC	200	NYSDEC TAGM	UG/KG	1.8	U	1.8	U	1.3	J	2	U	1.9	U	1.8	U
gamma-BHC (Lindane)	60	NYSDEC TAGM	UG/KG	1.8	U	1.8	U	2	UJ	2	U	1.9	U	1.8	U
gamma-Chlordane	540	NYSDEC TAGM	UG/KG	5.2		1.8	U	4.7	J	17.4		5.3		9.4	
OTHER ANALYSES															
Nitrate/Nitrite-Nitrogen			MG/KG	0.06		0.11		0.26		4.8		0.41		0.11	
Percent Moisture (PEST/PCB)				4		3				13		9		6	
Percent Moisture (SVOCs)				5		3				13		9		6	
Percent Moisture (VOCs)				5		1				11		7		5	
Percent Solids (Metals)				95.5		97.4				86.8		90.5		94.1	
Total Organic Carbon			MG/KG												
NITROAROMATICS															
2,4-Dinitrotoluene			UG/KG	310		180	J	1100		510		120	U	120	U
2,6-Dinitrotoluene	1000	NYSDEC TAGM	UG/KG	120	U	120	U	130	U	120	U	120	U	120	U
2-amino-4,6-Dinitrotoluene			UG/KG	120	U	120	U	430	J	120	U	120	U	120	U
Tetryl			UG/KG	120	U	120	U	220	J	120	U	120	U	120	U
METALS															
Aluminum	14592.8	NYSDEC TAGM	MG/KG	10000	J	3860	J	7250		8420	J	11300	J	12000	J
Antimony	3.59	NYSDEC TAGM	MG/KG	**6.7**	**J**	1	J	121	R	**28.1**	**J**	0.81	J	1.5	J
Arsenic	7.5	NYSDEC TAGM	MG/KG	5.2	J	2.9	J	**23.6**		**11.2**	**J**	6.6		5.1	

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-9
SEAD-16 Summary of Analytes Detected in Surface Soil

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS16-28		SS16-29		SS16-3		SS16-30		SS16-31		SS16-32	
			SAMP ID:	16044		16045		SS16-3-1		16048		16062		16052	
			QC CODE:	SA		SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		ESI		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/19/96		8/19/96		10/22/93		8/20/96		8/21/96		8/20/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Barium	300	NYSDEC TAGM	MG/KG	107	J	48.1	J	1540	R	**1220**	**J**	70.9	J	85.3	J
Beryllium	0.73	NYSDEC TAGM	MG/KG	0.36		0.17		0.39	J	0.27		0.47		0.42	
Cadmium	1	NYSDEC TAGM	MG/KG	0.3		0.11		**2.5**		**1.2**		0.49		0.5	
Calcium	101904	NYSDEC TAGM	MG/KG	57200		**260000**		21400		77300		32800		56100	
Chromium	22.13	NYSDEC TAGM	MG/KG	20.5		8.4		**33.3**		19.4		18.4		**24.5**	
Cobalt	30	NYSDEC TAGM	MG/KG	10.2	J	5.3		9.1		8.4		12.2		11.4	
Copper	25	NYSDEC TAGM	MG/KG	**192**	**J**	**28.3**	**J**	**1730**		**617**	**J**	**39.5**		**104**	
Cyanide	0.3	NYSDEC TAGM	MG/KG	0.49	U	0.47	U	0.68	U	0.51	U	0.54	U	0.49	U
Iron	26626.7	NYSDEC TAGM	MG/KG	21900	J	8870	J	25700		17600	J	23000	J	23900	
Lead	21.86	NYSDEC TAGM	MG/KG	**626**	**J**	**66.6**	**J**	**9140**		**2560**	**J**	**81.1**		**265**	
Magnesium	12221.8	NYSDEC TAGM	MG/KG	5510		4880		4300		9010		10700		11200	
Manganese	669.38	NYSDEC TAGM	MG/KG	322		215		**4140**		365		459		508	
Mercury	0.1	NYSDEC TAGM	MG/KG	**0.11**	**J**	0.03	U	**11.4**	**J**	**2.3**	**J**	0.07		**0.12**	
Nickel	33.62	NYSDEC TAGM	MG/KG	**35.1**	**J**	18.1	J	**37.3**		22.7	J	28.9		**36.3**	
Potassium	1761.48	NYSDEC TAGM	MG/KG	1300		972		886		1200		1260		**1840**	
Selenium	2	NYSDEC TAGM	MG/KG	0.66		0.43	U	0.22	UJ	0.66		0.71	U	0.76	
Silver	0.4	NYSDEC TAGM	MG/KG	**0.41**		0.37		1.1	UJ	**0.44**		0.26	U	0.35	
Sodium	103.74	NYSDEC TAGM	MG/KG	77.8		**115**		**147**	**J**	91.6		53.2		**126**	
Thallium	0.28	NYSDEC TAGM	MG/KG	0.86	U	0.75	U	0.24	U	0.71	U	**1.1**	**J**	**1**	**J**
Vanadium	150	NYSDEC TAGM	MG/KG	16.3	J	8.2		17.9		18.3	J	20.3		28.9	
Zinc	82.5	NYSDEC TAGM	MG/KG	**115**		42.7		**929**		**573**		**134**		**157**	
HERBICIDES															
2,4,5-T	1900	NYSDEC TAGM	UG/KG					7.2							
MCPP			UG/KG					6000	U						

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-9

SEAD-16 Summary of Analytes Detected in Surface Soil

SEAD-16 Remedial Investigation

Seneca Army Depot Activity

			LOC_ID:	SS16-33		SS16-34		SS16-35		SS16-36		SS16-37		SS16-38	
			SAMP ID:	16067		16053		16066		16061		16054		16068	
			QC CODE:	SA		SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/22/96		8/20/96		8/22/96		8/21/96		8/20/96		8/22/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
VOLATILE ORGANICS															
1,1,2,2-Tetrachloroethane	600	NYSDEC TAGM	UG/KG	11	U	21	U	10	UJ	10	UJ	11	U	10	UJ
Acetone	200	NYSDEC TAGM	UG/KG	11	UJ	15	U	10	UJ	10	UJ	11	U	10	UJ
Benzene	60	NYSDEC TAGM	UG/KG	11	U	21	U	10	U	5	J	11	U	10	UJ
Carbon Disulfide	2700	NYSDEC TAGM	UG/KG	11	U	21	U	10	U	2	J	11	U	10	UJ
Chloroform	300	NYSDEC TAGM	UG/KG	11	U	10	U	10	U	5	UJ	5	U	10	UJ
Methylene Chloride	100	NYSDEC TAGM	UG/KG	11	U	21	U	10	U	10	UJ	11	U	10	UJ
Toluene	1500	NYSDEC TAGM	UG/KG	11	UJ	21	U	10	UJ	10	J	11	U	10	UJ
Xylene (total)	1200	NYSDEC TAGM	UG/KG	11	UJ	21	U	10	UJ	10	UJ	11	U	10	UJ
SEMIVOLATILE ORGANICS															
2,4-Dinitrotoluene			UG/KG	510	U	1800	U	6900		700	U	350	U	350	U
2,6-Dinitrotoluene	1000	NYSDEC TAGM	UG/KG	510	U	1800	U	400	J	700	U	350	U	350	U
2-Methylnaphthalene	36400	NYSDEC TAGM	UG/KG	510	U	1800	U	850	U	700	U	350	U	350	U
3,3'-Dichlorobenzidine			UG/KG	510	UJ	1800	U	850	J	700	U	350	U	350	U
3-Nitroaniline	500	NYSDEC TAGM	UG/KG	1200	UJ	4200	U	**2100**	**J**	1700	U	860	U	840	U
Acenaphthene	50000	NYSDEC TAGM	UG/KG	55	J	1800	U	140	J	700	U	350	U	350	U
Acenaphthylene	41000	NYSDEC TAGM	UG/KG	40	J	1800	U	850	U	700	U	350	U	350	U
Anthracene	50000	NYSDEC TAGM	UG/KG	310	J	1800	U	260	J	700	U	350	U	350	U
Benzo(a)anthracene	224	NYSDEC TAGM	UG/KG	**1900**		1800	U	**1000**		700	U	350	U	17	J
Benzo(a)pyrene	61	NYSDEC TAGM	UG/KG	**1900**		1800	U	**1000**		700	U	350	U	19	J
Benzo(b)fluoranthene	1100	NYSDEC TAGM	UG/KG	**3300**	**J**	1800	U	850	U	700	U	350	U	350	U
Benzo(g,h,i)perylene	50000	NYSDEC TAGM	UG/KG	1000		1800	U	570	J	700	U	350	U	54	J
Benzo(k)fluoranthene	1100	NYSDEC TAGM	UG/KG	510	U	1800	U	**1700**	**J**	700	U	350	U	350	U
Carbazole			UG/KG	160	J	1800	U	410	J	700	U	350	U	350	U
Chrysene	400	NYSDEC TAGM	UG/KG	**1700**		1800	U	**910**		700	U	350	U	22	J

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-9
SEAD-16 Summary of Analytes Detected in Surface Soil

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS16-33		SS16-34		SS16-35		SS16-36		SS16-37		SS16-38	
			SAMP ID:	16067		16053		16066		16061		16054		16068	
			QC CODE:	SA		SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/22/96		8/20/96		8/22/96		8/21/96		8/20/96		8/22/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Di-n-butylphthalate	8100	NYSDEC TAGM	UG/KG	510	U	1800	U	2000		700	U	350	U	350	U
Dibenz(a,h)anthracene	14	NYSDEC TAGM	UG/KG	**700**		1800	U	**390**	**J**	700	U	350	U	350	U
Dibenzofuran	6200	NYSDEC TAGM	UG/KG	33	J	1800	U	62	J	700	U	350	U	350	U
Diethylphthalate	7100	NYSDEC TAGM	UG/KG	510	U	1800	U	850	U	700	U	350	U	350	U
Fluoranthene	50000	NYSDEC TAGM	UG/KG	2400		1800	U	2400		700	U	350	U	22	J
Fluorene	50000	NYSDEC TAGM	UG/KG	83	J	1800	U	110	J	700	U	350	U	350	U
Indeno(1,2,3-cd)pyrene	3200	NYSDEC TAGM	UG/KG	1500		1800	U	700	J	700	U	350	U	350	U
N-Nitrosodiphenylamine (1)			UG/KG	510	U	1800	U	760	J	700	U	350	U	350	U
Naphthalene	13000	NYSDEC TAGM	UG/KG	510	U	1800	U	850	U	700	U	350	U	350	U
Pentachlorophenol	1000	NYSDEC TAGM	UG/KG	**1200**	**J**	4200	U	2100	UJ	1700	U	860	U	840	UJ
Phenanthrene	50000	NYSDEC TAGM	UG/KG	1200		1800	U	1300		700	U	350	U	22	J
Pyrene	50000	NYSDEC TAGM	UG/KG	3200		1800	U	2000		700	U	350	U	31	J
bis(2-Ethylhexyl)phthalate	50000	NYSDEC TAGM	UG/KG	510	U	1800	U	990		700	U	350	U	350	U
PESTICIDES/PCB															
4,4'-DDD	2900	NYSDEC TAGM	UG/KG	1.6	J	3.5	U	34	U	3.5	R	3.5	U	3.5	U
4,4'-DDE	2100	NYSDEC TAGM	UG/KG	20		3.5	U	290		2.3	R	3.5	U	5.1	
4,4'-DDT	2100	NYSDEC TAGM	UG/KG	17		2.3	J	340		7.4	J	3.5	U	2.1	J
Aldrin	41	NYSDEC TAGM	UG/KG	1.9	U	1.8	U	18	U	1.8	R	1.8	U	1.8	U
Aroclor-1254	1000	NYSDEC TAGM	UG/KG	36	U	35	U	340	U	35	R	35	U	35	U
Aroclor-1260	1000	NYSDEC TAGM	UG/KG	36	U	35	U	160	J	35	R	35	U	35	U
Dieldrin	44	NYSDEC TAGM	UG/KG	3.6	U	3.5	U	34	U	3.5	R	3.5	U	3.5	U
Endosulfan I	900	NYSDEC TAGM	UG/KG	1.9	U	1.8	U	18	U	1.2	R	1.8	U	1.8	U
Endosulfan II	900	NYSDEC TAGM	UG/KG	3.6	U	3.5	U	34	U	3.5	R	3.5	U	3.5	U
Endosulfan sulfate	1000	NYSDEC TAGM	UG/KG	3.6	U	3.5	U	34	U	3.5	R	3.5	U	3.5	U
Endrin	100	NYSDEC TAGM	UG/KG	3.6	U	3.5	U	34	U	3.5	R	3.5	U	3.5	U

Note: Shaded values exceed the NYSDEC TAGM.

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Table 4-9

SEAD-16 Summary of Analytes Detected in Surface Soil

SEAD-16 Remedial Investigation

Seneca Army Depot Activity

			LOC_ID:	SS16-33		SS16-34		SS16-35		SS16-36		SS16-37		SS16-38	
			SAMP ID:	16067		16053		16066		16061		16054		16068	
			QC CODE:	SA		SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/22/96		8/20/96		8/22/96		8/21/96		8/20/96		8/22/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Endrin aldehyde			UG/KG	3.6	U	3.5	U	34	U	3.5	R	3.5	U	3.5	U
Endrin ketone			UG/KG	3.6	U	3.5	U	34	U	3.5	R	3.5	U	3.5	U
Heptachlor	100	NYSDEC TAGM	UG/KG	1.9	U	1.8	U	18	U	1.8	R	1.8	U	1.8	U
Heptachlor epoxide	20	NYSDEC TAGM	UG/KG	1.9	U	1.8	U	18	U	1.8	R	1.8	U	1.8	U
Toxaphene			UG/KG	190	U	180	U	1800	U	180	R	180	U	180	U
alpha-Chlordane			UG/KG	1.9	U	1.8	U	18	J	1.8	R	1.8	U	1.8	U
beta-BHC	200	NYSDEC TAGM	UG/KG	1.9	U	1.8	U	18	U	1.8	R	1.8	U	1.8	U
gamma-BHC (Lindane)	60	NYSDEC TAGM	UG/KG	1.9	U	1.8	U	18	U	1.8	R	1.8	U	1.8	U
gamma-Chlordane	540	NYSDEC TAGM	UG/KG	1.9	U	1.8	U	15	J	1.8	R	1.8	U	1.8	U
OTHER ANALYSES															
Nitrate/Nitrite-Nitrogen			MG/KG	0.04		0.04		0.08		0.16		0.02		1	
Percent Moisture (PEST/PCB)				9		6		4		6		7		6	
Percent Moisture (SVOCs)				9		6		4		6		7		6	
Percent Moisture (VOCs)				9		5		2		5		6		5	
Percent Solids (Metals)				90.6		93.9		95.9		94.4		93.3		94	
Total Organic Carbon			MG/KG											8400	
NITROAROMATICS															
2,4-Dinitrotoluene			UG/KG	120	U	4400		3000	J	120	U	120	U	120	U
2,6-Dinitrotoluene	1000	NYSDEC TAGM	UG/KG	120	U	120	U	120	U	120	U	120	U	120	U
2-amino-4,6-Dinitrotoluene			UG/KG	120	U	120	U	120	U	120	U	120	U	120	U
Tetryl			UG/KG	120	U	120	U	120	U	120	U	120	U	120	U
METALS															
Aluminum	14592.8	NYSDEC TAGM	MG/KG	13500	J	8660	J	6930	J	10200	J	10200	J	14400	
Antimony	3.59	NYSDEC TAGM	MG/KG	1.2	J	0.35	UJ	**7.1**	**J**	0.5	J	0.37	UJ	0.56	J
Arsenic	7.5	NYSDEC TAGM	MG/KG	6		5.8		5.3		6.7		5.5		3.8	

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-9
SEAD-16 Summary of Analytes Detected in Surface Soil

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS16-33		SS16-34		SS16-35		SS16-36		SS16-37		SS16-38	
			SAMP ID:	16067		16053		16066		16061		16054		16068	
			QC CODE:	SA		SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/22/96		8/20/96		8/22/96		8/21/96		8/20/96		8/22/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Barium	300	NYSDEC TAGM	MG/KG	70.7	J	47.7	J	**314**	**J**	42.3	J	42	J	127	J
Beryllium	0.73	NYSDEC TAGM	MG/KG	0.47		0.3		0.24		0.34		0.28		0.56	
Cadmium	1	NYSDEC TAGM	MG/KG	0.06	U	0.31		**5.3**		0.29		0.14		0.06	U
Calcium	101904	NYSDEC TAGM	MG/KG	10700		59700		**110000**		22400		24100		18000	
Chromium	22.13	NYSDEC TAGM	MG/KG	**22.6**		13.2		**35.3**		14.7		15.9		**25.4**	
Cobalt	30	NYSDEC TAGM	MG/KG	10.9		7.7		8.2		8.1		9.5		12.4	
Copper	25	NYSDEC TAGM	MG/KG	**44.6**		**41.5**		**407**		**34.4**		**30.9**		**34.4**	
Cyanide	0.3	NYSDEC TAGM	MG/KG	0.53	U	0.49	U	**1.5**		0.51	U	0.46	U	0.53	U
Iron	26626.7	NYSDEC TAGM	MG/KG	25800		20300		18300		22700	J	23700		26500	
Lead	21.86	NYSDEC TAGM	MG/KG	**131**		**43.7**		**1290**		**34.7**		**23.6**		**60.3**	
Magnesium	12221.8	NYSDEC TAGM	MG/KG	7130		7480		**27000**		10100		5890		6090	
Manganese	669.38	NYSDEC TAGM	MG/KG	443	J	422		375	J	337		502		391	J
Mercury	0.1	NYSDEC TAGM	MG/KG	**0.12**		0.03	U	**0.12**		0.04	U	0.04	U	0.04	U
Nickel	33.62	NYSDEC TAGM	MG/KG	31.2		23.7		28.6		24.7		27.6		**43.5**	
Potassium	1761.48	NYSDEC TAGM	MG/KG	1650		953		1340		1130		1300		**2020**	
Selenium	2	NYSDEC TAGM	MG/KG	0.52	U	0.62	U	1.2	J	0.55	U	0.66	U	0.55	J
Silver	0.4	NYSDEC TAGM	MG/KG	0.28	U	0.3		**0.5**		0.2	U	0.24	U	0.25	U
Sodium	103.74	NYSDEC TAGM	MG/KG	58	U	78.6		**137**		41.1	U	83.2		84.1	
Thallium	0.28	NYSDEC TAGM	MG/KG	0.91	U	**0.98**		0.78	U	0.64	U	0.77	U	0.82	U
Vanadium	150	NYSDEC TAGM	MG/KG	22.7		28.4		33.8		18.8		18.2		22.6	
Zinc	82.5	NYSDEC TAGM	MG/KG	**109**	**J**	**109**		**466**	**J**	**95.7**		80.6		**117**	**J**
HERBICIDES															
2,4,5-T	1900	NYSDEC TAGM	UG/KG												
MCPP			UG/KG												

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-9
SEAD-16 Summary of Analytes Detected in Surface Soil

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS16-4		SS16-5		SS16-6		SS16-7		SS16-8		SS16-9	
			SAMP ID:	SS16-4-1		SS16-5-1		SS16-6-1		SS16-7-1		SS16-8-1		SS16-9-1	
			QC CODE:	SA		SA		SA		SA		SA		SA	
			STUDY ID:	ESI		ESI		ESI		ESI		ESI		ESI	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	10/20/93		10/20/93		10/20/93		10/20/93		10/20/93		11/9/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
VOLATILE ORGANICS															
1,1,2,2-Tetrachloroethane	600	NYSDEC TAGM	UG/KG	11	U	11	U	10	U	53	U	10	U	11	U
Acetone	200	NYSDEC TAGM	UG/KG	17		11	U	10	U	53	U	10	U	11	U
Benzene	60	NYSDEC TAGM	UG/KG	11	U	11	U	10	U	53	U	10	U	11	U
Carbon Disulfide	2700	NYSDEC TAGM	UG/KG	11	U	11	U	10	U	53	U	10	U	11	U
Chloroform	300	NYSDEC TAGM	UG/KG	11	U	11	U	2	J	53	U	10	U	11	U
Methylene Chloride	100	NYSDEC TAGM	UG/KG	11	U	2	J	10	U	53	U	10	U	11	U
Toluene	1500	NYSDEC TAGM	UG/KG	11	U	5	J	3	J	53	U	2	J	11	U
Xylene (total)	1200	NYSDEC TAGM	UG/KG	11	U	11	U	10	U	53	U	10	U	11	U
SEMIVOLATILE ORGANICS															
2,4-Dinitrotoluene			UG/KG	7200	U	530	J	14000	U	1300	U	1800	U	2700	U
2,6-Dinitrotoluene	1000	NYSDEC TAGM	UG/KG	7200	U	750	U	14000	U	1300	U	1800	U	2700	U
2-Methylnaphthalene	36400	NYSDEC TAGM	UG/KG	7200	U	97	J	14000	U	1300	U	1800	U	2700	U
3,3'-Dichlorobenzidine			UG/KG	7200	U	750	U	14000	U	1300	U	1800	U	2700	U
3-Nitroaniline	500	NYSDEC TAGM	UG/KG	18000	U	1800	U	34000	U	3100	U	4200	U	6600	U
Acenaphthene	50000	NYSDEC TAGM	UG/KG	7200	U	44	J	14000	U	1300	U	1800	U	2700	U
Acenaphthylene	41000	NYSDEC TAGM	UG/KG	7200	U	750	U	14000	U	1300	U	1800	U	2700	U
Anthracene	50000	NYSDEC TAGM	UG/KG	7200	U	70	J	14000	U	1300	U	1800	U	2700	U
Benzo(a)anthracene	224	NYSDEC TAGM	UG/KG	7200	U	**240**	**J**	14000	U	1300	U	1800	U	2700	U
Benzo(a)pyrene	61	NYSDEC TAGM	UG/KG	7200	U	**270**	**J**	14000	U	1300	U	1800	U	2700	U
Benzo(b)fluoranthene	1100	NYSDEC TAGM	UG/KG	7200	U	350	J	14000	U	1300	U	1800	U	2700	U
Benzo(g,h,i)perylene	50000	NYSDEC TAGM	UG/KG	7200	U	180	J	14000	U	1300	U	1800	U	2700	U
Benzo(k)fluoranthene	1100	NYSDEC TAGM	UG/KG	7200	U	330	J	14000	U	1300	U	1800	U	2700	U
Carbazole			UG/KG	7200	U	78	J	14000	U	1300	U	1800	U	2700	U
Chrysene	400	NYSDEC TAGM	UG/KG	7200	U	340	J	14000	U	1300	U	1800	U	2700	U

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-9
SEAD-16 Summary of Analytes Detected in Surface Soil

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS16-4		SS16-5		SS16-6		SS16-7		SS16-8		SS16-9	
			SAMP ID:	SS16-4-1		SS16-5-1		SS16-6-1		SS16-7-1		SS16-8-1		SS16-9-1	
			QC CODE:	SA		SA		SA		SA		SA		SA	
			STUDY ID:	ESI		ESI		ESI		ESI		ESI		ESI	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	10/20/93		10/20/93		10/20/93		10/20/93		10/20/93		11/9/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Di-n-butylphthalate	8100	NYSDEC TAGM	UG/KG	7200	U	350	J	14000	U	1300	U	1400	J	510	J
Dibenz(a,h)anthracene	14	NYSDEC TAGM	UG/KG	7200	U	750	U	14000	U	1300	U	1800	U	2700	U
Dibenzofuran	6200	NYSDEC TAGM	UG/KG	7200	U	82	J	14000	U	1300	U	1800	U	2700	U
Diethylphthalate	7100	NYSDEC TAGM	UG/KG	7200	U	750	U	14000	U	1300	U	1800	U	2700	U
Fluoranthene	50000	NYSDEC TAGM	UG/KG	7200	U	710	J	14000	U	1300	U	1800	U	2700	U
Fluorene	50000	NYSDEC TAGM	UG/KG	7200	U	750	U	14000	U	1300	U	1800	U	2700	U
Indeno(1,2,3-cd)pyrene	3200	NYSDEC TAGM	UG/KG	7200	U	200	J	14000	U	1300	U	1800	U	2700	U
N-Nitrosodiphenylamine (1)			UG/KG	7200	U	130	J	14000	U	1300	U	350	J	2700	U
Naphthalene	13000	NYSDEC TAGM	UG/KG	7200	U	750	U	14000	U	1300	U	1800	U	2700	U
Pentachlorophenol	1000	NYSDEC TAGM	UG/KG	18000	U	1800	U	34000	U	3100	U	4200	U	6600	U
Phenanthrene	50000	NYSDEC TAGM	UG/KG	7200	U	410	J	14000	U	1300	U	1800	U	2700	U
Pyrene	50000	NYSDEC TAGM	UG/KG	7200	U	550	J	14000	U	1300	U	1800	U	160	J
bis(2-Ethylhexyl)phthalate	50000	NYSDEC TAGM	UG/KG	7200	U	450	J	14000	U	1300	U	1800	U	2100	J
PESTICIDES/PCB															
4,4'-DDD	2900	NYSDEC TAGM	UG/KG	36	U	19	U	3.5	UJ	3.5	U	7	U	3.5	UJ
4,4'-DDE	2100	NYSDEC TAGM	UG/KG	1400		130		3.5	UJ	6.3		84	J	2.8	J
4,4'-DDT	2100	NYSDEC TAGM	UG/KG	180		29		1.8	J	5.6		79	J	2.9	J
Aldrin	41	NYSDEC TAGM	UG/KG	19	U	9.7	U	1.8	UJ	1.8	U	3.6	U	1.8	UJ
Aroclor-1254	1000	NYSDEC TAGM	UG/KG	360	U	190	U	35	UJ	35	U	57	UJ	35	UJ
Aroclor-1260	1000	NYSDEC TAGM	UG/KG	360	U	190	U	35	UJ	35	U	70	U	35	UJ
Dieldrin	44	NYSDEC TAGM	UG/KG	36	U	19	U	3.5	UJ	3.5	U	7	U	3.5	UJ
Endosulfan I	900	NYSDEC TAGM	UG/KG	19	U	6.2	J	1.8	UJ	1.8	U	1.9	J	1.8	UJ
Endosulfan II	900	NYSDEC TAGM	UG/KG	36	U	19	U	3.5	UJ	2.2	J	7	U	3.5	UJ
Endosulfan sulfate	1000	NYSDEC TAGM	UG/KG	36	U	19	U	3.5	UJ	3.5	U	7	U	3.5	UJ
Endrin	100	NYSDEC TAGM	UG/KG	36	U	19	U	3.5	UJ	3.5	U	7	U	3.5	UJ

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-9
SEAD-16 Summary of Analytes Detected in Surface Soil

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS16-4		SS16-5		SS16-6		SS16-7		SS16-8		SS16-9	
			SAMP ID:	SS16-4-1		SS16-5-1		SS16-6-1		SS16-7-1		SS16-8-1		SS16-9-1	
			QC CODE:	SA		SA		SA		SA		SA		SA	
			STUDY ID:	ESI		ESI		ESI		ESI		ESI		ESI	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	10/20/93		10/20/93		10/20/93		10/20/93		10/20/93		11/9/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Endrin aldehyde			UG/KG	36	U	19	U	3.5	UJ	3.5	U	7	U	3.5	UJ
Endrin ketone			UG/KG	36	U	19	U	3.5	UJ	3.5	U	7	U	3.5	UJ
Heptachlor	100	NYSDEC TAGM	UG/KG	19	U	9.7	U	1.8	UJ	1.8	U	3.6	U	1.8	UJ
Heptachlor epoxide	20	NYSDEC TAGM	UG/KG	19	U	9.7	U	1.8	UJ	1.8	U	3.6	U	1.8	UJ
Toxaphene			UG/KG	1900	U	970	U	180	UJ	180	U	360	U	180	UJ
alpha-Chlordane			UG/KG	19	U	9.7	U	1.8	UJ	6.1		3.6	U	1.8	UJ
beta-BHC	200	NYSDEC TAGM	UG/KG	19	U	9.7	U	1.8	UJ	1.8	U	3.6	U	1.8	UJ
gamma-BHC (Lindane)	60	NYSDEC TAGM	UG/KG	19	U	9.7	U	1.8	UJ	1.8	U	3.6	U	1.8	UJ
gamma-Chlordane	540	NYSDEC TAGM	UG/KG	19	U	9.7	U	1.8	UJ	7		3.6	U	1.8	UJ
OTHER ANALYSES															
Nitrate/Nitrite-Nitrogen			MG/KG	0.45		0.5		0.42		0.05		0.23		0.01	U
Percent Moisture (PEST/PCB)															
Percent Moisture (SVOCs)															
Percent Moisture (VOCs)															
Percent Solids (Metals)															
Total Organic Carbon			MG/KG												
NITROAROMATICS															
2,4-Dinitrotoluene			UG/KG	170		780	J	130	U	130	U	770		450	J
2,6-Dinitrotoluene	1000	NYSDEC TAGM	UG/KG	130	U	130	U	130	U	130	U	130	U	130	U
2-amino-4,6-Dinitrotoluene			UG/KG	130	U	130	U	130	U	130	U	130	U	130	U
Tetryl			UG/KG	130	U	130	U	130	U	130	U	130	U	130	U
METALS															
Aluminum	14592.8	NYSDEC TAGM	MG/KG	11900		13600		9650		8670		7600		10700	
Antimony	3.59	NYSDEC TAGM	MG/KG	**26.3**		**27.3**		7.9	U	8.8	U	8.2	U	7	U
Arsenic	7.5	NYSDEC TAGM	MG/KG	**11.3**		**10.8**		5.1		5		5.2		4.2	J

Note: Shaded values exceed the NYSDEC TAGM.
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Table 4-9
SEAD-16 Summary of Analytes Detected in Surface Soil

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS16-4		SS16-5		SS16-6		SS16-7		SS16-8		SS16-9	
			SAMP ID:	SS16-4-1		SS16-5-1		SS16-6-1		SS16-7-1		SS16-8-1		SS16-9-1	
			QC CODE:	SA		SA		SA		SA		SA		SA	
			STUDY ID:	ESI		ESI		ESI		ESI		ESI		ESI	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	10/20/93		10/20/93		10/20/93		10/20/93		10/20/93		11/9/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Barium	300	NYSDEC TAGM	MG/KG	227		**630**		45.1		41.2		72.2		53.6	
Beryllium	0.73	NYSDEC TAGM	MG/KG	0.45	J	0.56	J	0.24	J	0.29	J	0.39	J	0.43	J
Cadmium	1	NYSDEC TAGM	MG/KG	0.55	U	**2.8**		0.49	U	0.55	U	0.52	U	0.43	UR
Calcium	101904	NYSDEC TAGM	MG/KG	55600		37100		25600		36600		**107000**		35400	
Chromium	22.13	NYSDEC TAGM	MG/KG	**24**		**43.3**		12.9	R	11.9		15.9		17.6	
Cobalt	30	NYSDEC TAGM	MG/KG	11.9		13.4		7.9		7.5	J	8.1		8.2	
Copper	25	NYSDEC TAGM	MG/KG	**399**		**635**		**26.2**		**28.9**		**88.9**		**31.4**	**J**
Cyanide	0.3	NYSDEC TAGM	MG/KG	0.6	U	0.63	U	0.58	U	0.6	U	0.58	U	0.52	U
Iron	26626.7	NYSDEC TAGM	MG/KG	**27700**		**36500**		22100		20000		16700		22400	
Lead	21.86	NYSDEC TAGM	MG/KG	**2940**		**2860**		8.5		**81.2**		**1890**		**76.2**	
Magnesium	12221.8	NYSDEC TAGM	MG/KG	8690		7930		7710		**13800**		9940		**15300**	
Manganese	669.38	NYSDEC TAGM	MG/KG	411	J	444	J	305	J	478	J	333	J	349	
Mercury	0.1	NYSDEC TAGM	MG/KG	**0.21**		**0.99**		0.03	U	0.04	U	0.08		0.05	J
Nickel	33.62	NYSDEC TAGM	MG/KG	**41.6**		**148**		22.7		21.7		28.7		29.3	
Potassium	1761.48	NYSDEC TAGM	MG/KG	1250		1410		720	J	794	J	1150		1160	
Selenium	2	NYSDEC TAGM	MG/KG	0.2	UJ	0.22	UJ	0.13	UJ	0.13	UJ	0.21	UJ	0.19	UJ
Silver	0.4	NYSDEC TAGM	MG/KG	1.1	U	1	U	1	U	1.1	U	1	U	0.88	UJ
Sodium	103.74	NYSDEC TAGM	MG/KG	**128**	**J**	**132**	**J**	79.6	J	**109**	**J**	**170**	**J**	**125**	**J**
Thallium	0.28	NYSDEC TAGM	MG/KG	0.22	U	0.24	U	0.14	U	0.14	U	0.23	U	0.21	UJ
Vanadium	150	NYSDEC TAGM	MG/KG	20.3		23.9		38.1		35.7		34.5		22.8	
Zinc	82.5	NYSDEC TAGM	MG/KG	**416**		**562**		65.8		66.1		**105**		78.8	J
HERBICIDES															
2,4,5-T	1900	NYSDEC TAGM	UG/KG	5.5	U	5.7	U	5.3	U	5.3	U	5.3	U	5.5	U
MCPP			UG/KG	5500	U	16000		5300	U	5300	U	5300	U	5500	U

Note: Shaded values exceed the NYSDEC TAGM.
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p.xls

Table 4-10

VOCs and TICs in Surface Soil (ug/Kg)

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Surface Soil Location	Surface Soil Sample ID	Study ID	Total TCL VOCs	Total TICs	Total All VOCs
SB16-1	16038	Round I	11	0	11
SB16-3	16032 (1)	Round I	0	54	54
SB16-3	16033	Round I	17	722	739
SB16-4	16030	Round I	10	21	31
SS16-1	SS16-1-1	ESI	0	0	0
SS16-2	SS16-2-1	ESI	1	0	1
SS16-3	SS16-3-1	ESI	4	73	77
SS16-4	SS16-4-1	ESI	17	0	17
SS16-5	SS16-5-1	ESI	7	122	129
SS16-6	SS16-6-1	ESI	5	90	95
SS16-7	SS16-7-1	ESI	0	5310	5310
SS16-8	SS16-8-1	ESI	2	0	2
SS16-9	SS16-9-1	ESI	0	70	70
SS16-10	SS16-10-1	ESI	0	55	55
SS16-11	SS16-11-1	ESI	0	0	0
SS16-12	SS16-12-1	ESI	5	180	185
SS16-13	SS16-13-1	ESI	0	0	0
SS16-14	SS16-14-1	ESI	4	0	4
SS16-15	SS16-15-1	ESI	0	0	0
SS16-16	SS16-16-1	ESI	0	98	98
SS16-17	16040	Round I	0	0	0
SS16-18	16041	Round I	0	0	0
SS16-19	16042	Round I	2	170	172
SS16-20	16043	Round I	5	11	16
SS16-21	16058	Round I	0	0	0
SS16-21	16059 (2)	Round I	2	0	2
SS16-22	16049	Round I	0	13	13
SS16-23	16051	Round I	0	35	35
SS16-24	16060	Round I	6	0	6
SS16-25	16050	Round I	4	7	11
SS16-26	16046	Round I	1	0	1
SS16-27	16047	Round I	3	0	3
SS16-28	16044	Round I	0	0	0
SS16-29	16045	Round I	6	122	128
SS16-30	16048	Round I	0	6	6
SS16-31	16062	Round I	0	0	0
SS16-32	16052	Round I	0	116	116
SS16-33	16067	Round I	0	0	0
SS16-34	16053	Round I	0	4520	4520
SS16-35	16066	Round I	0	0	0
SS16-36	16061	Round I	17	76	93
SS16-37	16054	Round I	0	374	374
SS16-38	16068	Round I	0	5	5
500S	16086	Round I	0	0	0
1000S	16087	Round I	0	NA	NA
2000S	16085	Round I	0	0	0
3000S	16056	Round I	0	0	0
3500S	16055	Round I	2	23	25
500N	16074	Round I	0	0	0
1000N	16083	Round I	0	0	0
2000N	16089	Round I	0	NA	NA
2000N	16090 (3)	Round I	0	NA	NA
3000N	16088	Round I	0	NA	NA
3500N	16084	Round I	5	0	5

(1) Sample 16033 is a duplicate of sample 16032.
(2) Sample 16059 is a duplicate sample of 16058.
(3) Sample 16090 is a duplicate sample of 16089
NA- Not Available

Table 4-11
SEAD-16 Summary of Analytes Detected in Subsurface Soil

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SB16-1		SB16-1		SB16-2		SB16-4		SB16-5		SB16-5	
			SAMP ID:	16038		16093		16036		16031		16034		16035	
			QC CODE:	SA		SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	2		6		1		2		1		2	
			BOTTOM:	3		12		2		4		2		3.3	
			MATRIX:	SOIL		SOIL		SOIL		SOIL		SOIL		SOIL	
			SAMPLE DATE:	8/14/96		8/22/96		8/14/96		8/14/96		8/14/96		8/14/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
VOLATILE ORGANICS															
2-Butanone	300	NYSDEC TAGM	UG/KG	12	U	11	U	11	U	5	J	2	U	11	U
Acetone	200	NYSDEC TAGM	UG/KG	11	J	11	U	11	U	46		12	U	11	U
Benzene	60	NYSDEC TAGM	UG/KG	12	U	11	U	2	J	2	J	11	U	11	U
Toluene	1500	NYSDEC TAGM	UG/KG	12	U	11	UJ	3	J	2	J	2	J	6	J
SEMIVOLATILE ORGANICS															
2,4-Dinitrotoluene			UG/KG	390	U	67	J	1700		1900	U	1800	U	370	U
2,6-Dinitrotoluene	1000	NYSDEC TAGM	UG/KG	390	U	340	U	160	J	1900	U	1800	U	370	U
2-Methylnaphthalene	36400	NYSDEC TAGM	UG/KG	390	U	340	U	190	J	1900	U	1800	U	370	U
Acenaphthene	50000	NYSDEC TAGM	UG/KG	390	U	340	U	380	U	1900	U	1100	J	370	U
Acenaphthylene	41000	NYSDEC TAGM	UG/KG	390	U	340	U	380	U	300	J	1800	U	370	U
Anthracene	50000	NYSDEC TAGM	UG/KG	390	U	340	U	380	U	310	J	2000		40	J
Benzo(a)anthracene	224	NYSDEC TAGM	UG/KG	390	U	340	U	55	J	**420**	**J**	**6600**		110	J
Benzo(a)pyrene	61	NYSDEC TAGM	UG/KG	390	U	20	J	**63**	**J**	**1400**	**J**	**6200**		**170**	**J**
Benzo(b)fluoranthene	1100	NYSDEC TAGM	UG/KG	390	U	18	J	72	J	670	J	**6000**		110	J
Benzo(g,h,i)perylene	50000	NYSDEC TAGM	UG/KG	390	U	26	J	84	J	11000		4500		660	
Benzo(k)fluoranthene	1100	NYSDEC TAGM	UG/KG	390	U	20	J	60	J	690	J	**5600**		110	J
Butylbenzylphthalate	50000	NYSDEC TAGM	UG/KG	390	U	18	J	380	U	1900	U	1800	U	370	U
Carbazole			UG/KG	390	U	340	U	380	U	1900	U	730	J	370	U
Chrysene	400	NYSDEC TAGM	UG/KG	390	U	22	J	90	J	**480**	**J**	**7000**		120	J
Di-n-butylphthalate	8100	NYSDEC TAGM	UG/KG	390	U	35	J	240	J	1900	U	1800	U	370	U
Dibenz(a,h)anthracene	14	NYSDEC TAGM	UG/KG	390	U	340	U	**32**	**J**	**2500**		**1700**	**J**	**220**	**J**

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-11
SEAD-16 Summary of Analytes Detected in Subsurface Soil

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SB16-1		SB16-1		SB16-2		SB16-4		SB16-5		SB16-5	
			SAMP ID:	16038		16093		16036		16031		16034		16035	
			QC CODE:	SA		SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	2		6		1		2		1		2	
			BOTTOM:	3		12		2		4		2		3.3	
			MATRIX:	SOIL		SOIL		SOIL		SOIL		SOIL		SOIL	
			SAMPLE DATE:	8/14/96		8/22/96		8/14/96		8/14/96		8/14/96		8/14/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Dibenzofuran	6200	NYSDEC TAGM	UG/KG	390	U	340	U	45	J	1900	U	270	J	370	U
Fluoranthene	50000	NYSDEC TAGM	UG/KG	390	U	32	J	110	J	480	J	13000		190	J
Fluorene	50000	NYSDEC TAGM	UG/KG	390	U	340	U	380	U	1900	U	800	J	370	U
Indeno(1,2,3-cd)pyrene	3200	NYSDEC TAGM	UG/KG	390	U	24	J	65	J	**7100**		**3900**		510	
N-Nitrosodiphenylamine (1)			UG/KG	390	U	340	U	530		1900	U	1800	U	370	U
Naphthalene	13000	NYSDEC TAGM	UG/KG	390	U	340	U	120	J	1900	U	1800	U	370	U
Pentachlorophenol	1000	NYSDEC TAGM	UG/KG	940	U	830	U	920	U	4600	U	4400	U	120	J
Phenanthrene	50000	NYSDEC TAGM	UG/KG	390	U	23	J	160	J	160	J	7600		100	J
Pyrene	50000	NYSDEC TAGM	UG/KG	390	U	25	J	80	J	550	J	11000		160	J
bis(2-Ethylhexyl)phthalate	50000	NYSDEC TAGM	UG/KG	390	U	340	U	110	J	1900	U	1800	U	370	U
PESTICIDES/PCB															
4,4'-DDE	2100	NYSDEC TAGM	UG/KG	3.9	U	8.3		38	U	3.8	U	37	U	3.7	U
4,4'-DDT	2100	NYSDEC TAGM	UG/KG	3.9	U	1.7	J	38	U	3.8	U	37	U	3.4	J
Dieldrin	44	NYSDEC TAGM	UG/KG	3.9	U	3.4	U	38	U	12		37	U	3.7	U
Endosulfan I	900	NYSDEC TAGM	UG/KG	2	U	1.8	U	20	U	7.3	J	15	U	2.4	J
Endrin	100	NYSDEC TAGM	UG/KG	3.9	U	3.4	U	38	U	2.9	J	37	U	3.4	U
OTHER ANALYSES															
Nitrate/Nitrite-Nitrogen			MG/KG	0.11		0.32		0.78		0.3		0.09		0.17	
Percent Moisture (PEST/PCB)				15		4		13		13		10		11	
Percent Moisture (SVOCs)				15		4		13		13		10		11	
Percent Moisture (VOCs)				16		6		12		10		13		13	
Percent Solids (Metals)				85.3		95.6		87.3		87.2		89.8		88.7	

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-11
SEAD-16 Summary of Analytes Detected in Subsurface Soil

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SB16-1		SB16-1		SB16-2		SB16-4		SB16-5		SB16-5	
			SAMP ID:	16038		16093		16036		16031		16034		16035	
			QC CODE:	SA		SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	2		6		1		2		1		2	
			BOTTOM:	3		12		2		4		2		3.3	
			MATRIX:	SOIL		SOIL		SOIL		SOIL		SOIL		SOIL	
			SAMPLE DATE:	8/14/96		8/22/96		8/14/96		8/14/96		8/14/96		8/14/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Total Organic Carbon			MG/KG					9850				668		1010	
NITROAROMATICS															
2,4-Dinitrotoluene			UG/KG	120	U	280	J	150	J	500		120	U	120	U
METALS															
Aluminum	14592.84	NYSDEC TAGM	MG/KG	13200	R	12800	J	9350	R	13200	R	9850	R	10500	R
Antimony	3.59	NYSDEC TAGM	MG/KG	0.45	UJ	3.3	J	**8.3**	**J**	0.41	UJ	**135**	**J**	0.4	UJ
Arsenic	7.5	NYSDEC TAGM	MG/KG	3.3	J	6.3	J	6.9	J	5.2	J	6.9	J	5	J
Barium	300	NYSDEC TAGM	MG/KG	98	J	125	J	197	J	51.8	J	**302**	**J**	84.7	J
Beryllium	0.73	NYSDEC TAGM	MG/KG	0.51		0.42		0.29		0.43		0.34		0.29	
Cadmium	1	NYSDEC TAGM	MG/KG	0.07	U	0.19		0.45		0.06		0.09		0.09	
Calcium	101903.8	NYSDEC TAGM	MG/KG	67700		22500		24400		25000		37100		97900	
Chromium	22.13	NYSDEC TAGM	MG/KG	18.2		20.9		15.4		21.1		18		16.7	
Cobalt	30	NYSDEC TAGM	MG/KG	7		12.1		10.2	J	12.2	J	11.5	J	11.2	J
Copper	25	NYSDEC TAGM	MG/KG	23.6	J	**66.4**		**206**	**J**	16.4	J	**736**	**J**	**26.6**	**J**
Cyanide	0.3	NYSDEC TAGM	MG/KG	0.58	UJ	0.5	U	0.56	UJ	**0.52**	**J**	0.5	UJ	0.51	UJ
Iron	26626.65	NYSDEC TAGM	MG/KG	20700	J	**31400**		23900	J	**27300**	**J**	21800	J	21500	J
Lead	21.86	NYSDEC TAGM	MG/KG	12.6	J	**309**		**791**	**J**	21.4	J	**35400**	**J**	**61.6**	**J**
Magnesium	12221.77	NYSDEC TAGM	MG/KG	**12600**		6230		7250		**13300**		7410		11500	
Manganese	669.38	NYSDEC TAGM	MG/KG	210		586		606	J	457	J	315	J	650	J
Mercury	0.1	NYSDEC TAGM	MG/KG	0.04	U	**0.48**		**1.9**	**J**	0.04	J	**0.54**	**J**	0.03	U
Nickel	33.62	NYSDEC TAGM	MG/KG	23.8	J	**34.5**		23.9	J	30.7	J	**37**	**J**	29.2	J
Potassium	1761.48	NYSDEC TAGM	MG/KG	**1990**		1310		1290		1180		1160		1470	

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-11
SEAD-16 Summary of Analytes Detected in Subsurface Soil

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SB16-1		SB16-1		SB16-2		SB16-4		SB16-5		SB16-5	
			SAMP ID:	16038		16093		16036		16031		16034		16035	
			QC CODE:	SA		SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	2		6		1		2		1		2	
			BOTTOM:	3		12		2		4		2		3.3	
			MATRIX:	SOIL		SOIL		SOIL		SOIL		SOIL		SOIL	
			SAMPLE DATE:	8/14/96		8/22/96		8/14/96		8/14/96		8/14/96		8/14/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Selenium	2	NYSDEC TAGM	MG/KG	0.54	UJ	1.2		0.82	J	0.64	J	0.5	UJ	0.48	UJ
Silver	0.4	NYSDEC TAGM	MG/KG	0.29	U	0.26	U	0.25		0.27	U	**1.2**		0.26	U
Sodium	103.74	NYSDEC TAGM	MG/KG	59.8	U	54.4	U	59.2		**160**		56.3	U	82.9	
Thallium	0.28	NYSDEC TAGM	MG/KG	0.94	U	0.85	U	**0.91**		0.87	U	88.2	U	0.85	U
Vanadium	150	NYSDEC TAGM	MG/KG	22.6	J	19.3		17.1	J	19.6	J	15.2	J	17.6	J
Zinc	82.5	NYSDEC TAGM	MG/KG	54.8		**119**		**183**		**89.2**		**165**		70.9	

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-12

VOCs and TICs in Subsurface Soil (ug/Kg)

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Soil Boring Location	Soil Boring Sample ID	Study ID	Total VOCs	Total TICs	Total All VOCs
SB16-1	16039	Round I	0	0	0
SB16-1	16038	Round I	11	0	11
SB16-2	16036	Round I	5	0	5
SB16-4	16031	Round I	55	94	149
SB16-5	16034	Round I	2	0	2
SB16-5	16035	Round I	6	9	15

In addition to the NYSDEC TCL-listed VOCs, TICs were estimated for the subsurface soil samples (Table 4-12). The highest concentration of TICs (94 µg/kg) was found in the 2-4 foot sample at SB16-4. This sample also contained the highest total VOC concentration (149 µg/kg), which reflects that total of TCL-listed compounds and TICs. This concentration is below the NYSDEC TAGM criteria value of 10,000 µg/kg for total VOCs.

Downwind Surface Soils

A total of eleven downwind surface soil samples were collected as part of the RI field program for SEAD-16 (Table 4-13). The samples were collected along the two primary wind directions, i.e., north-northwest and south-southeast. Six samples were collected to the north-northwest and five samples were collected to the south-southeast.

The two VOC compounds, benzene and toluene, were detected in two downwind surface soil samples, however, both compounds were detected at concentrations far below their respective NYSDEC TAGM values. The two downwind surface soil samples that contained these VOCs were located 3,500 feet north and south of the site.

4.1.4.2 Semivolatile Organic Compounds

Surface Soils

SVOCs, mainly PAHs, were detected in the surface soils samples at SEAD-16 (Table 4-9). Sixteen PAH compounds were detected at concentrations above their respective TAGM values. Generally, the PAHs exceeded their TAGM values in samples collected from locations adjacent to the Abandoned Deactivation Furnace and the railroad tracks.

The highest concentrations of carcinogenic PAH compounds were detected in the three surface soil samples, SS16-31, SS16-33, and SB16-4, located near the northwest side of the Abandoned Deactivation Furnace. Figure 4-1 shows the distribution of total carcinogenic PAH compounds. The highest total carcinogenic PAH concentration (1,159,000 µg/kg) was found in SS16-31, which was located between the railroad tracks near the northwest corner of the Abandoned Deactivation Furnace. The second highest total carcinogenic PAH concentration was 20,100 µg/kg at soil boring SB16-4 at a depth of 0-2 inches. SB16-4 is located adjacent to the northwestern side of the Abandoned Deactivation Furnace building. The third highest concentration of total carcinogenic PAHs was 11,000 µg/kg detected at SS16-33, which is located adjacent to the railroad tracks on the northwest portion of the site. One phenol, pentachlorophenol, was detected in only one sample at a concentration of 1,200 J µg/kg in SS16-33.

One phthalate was detected in 17 of the 43 surface soil samples. Di-n-butylphthalate was detected at a maximum concentration of 16,000 µg/kg which is above the NYSDEC TAGM criteria of 8,100 µg/kg. This sample was the only sample in which the phthalate compound exceeded the NYSDEC TAGM criteria. This Phthalate appears in laboratory blanks and is likely a laboratory contaminant. It is not believed to be representative of the soil chemistry at SEAD-16.

The compounds 2,6-dinitrotoluene and 3-nitroaniline were also detected in the surface soil samples at concentrations above their respective TAGM values. 2,6-Dinitrotoluene was detected in surface soil samples SS16-21 (1,200 J µg/kg) and SS16-27 (8,000 J µg/kg) at concentrations above the NYSDEC TAGM criteria of 1,000 µg/kg. 3-Nitroaniline was detected in only one sample, SS16-35, at a concentration of 2,100 J µg/kg, which is above the NYSDEC TAGM criteria of 500 µg/kg.

All detection limits for the SVOC compound dibenz(a,h)anthrancene were above the NYSDEC TAGM value of 14 µg/kg. In addition, the following samples had elevated detection limits: SB16-3, SS16-4, SS16-6, SS16-7, SS16-8, SS16-9, SS16-10, SS16-16, SS16-21, SS16-27, SS16-31, and SS16-34.

In addition to the NYSDEC TCL-listed SVOCs, TICs were quantified for the samples (Table 4-14). The highest concentration of TICs (1,233,000 µg/kg) was found at SB16-31. The sample from location SS16-31 also contained the highest total SVOC concentration (4,366,000 µg/kg), which is comprised of TCL-listed compounds and TICs. This concentration is above the NYSDEC TAGM criteria value of 500,000 µg/kg for total SVOCs.

Subsurface Soils

SVOCs were detected in five of the six subsurface soils samples at SEAD-16, and the NYSDEC TAGMs for soil were exceeded in four subsurface samples, SB16-2 (1-2 feet), SB16-4 (2-4 feet), SB16-5 (1-2 feet and 2-3.3 feet) (Table 4-11). SVOCs belonging to the PAH group exceeded their respective TAGM values at these locations. Phthalates were also detected in the samples.

The PAHs exceeded their TAGMs in samples from borings adjacent to the Abandoned Deactivation Furnace. Twenty-two PAH compounds were detected. The highest concentrations of the total carcinogenic PAHs were also detected in the two soil borings located adjacent to the Abandoned Deactivation Furnace Building. The highest total carcinogenic PAH concentration (37,000 µg/kg) was found in SB16-5. SB16-5 is located adjacent to the southeastern side of the Abandoned Deactivation Furnace. The total carcinogenic PAH concentration at soil boring SB16-4 at a depth of 2-4 feet bgs was 16,900 µg/kg, which is the next highest concentration.

Table 4-13
SEAD-16 Summary of Analytes Detected in Downwind Surface Soil

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS16-500-N		SS16-500-S		1000-N		1000-S		2000-N		2000-N	
			SAMP ID:	16074		16086		16083		16087		16089		16090	
			QC CODE:	SA		SA		SA		SA		SA		DU	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/22/96		8/22/96		8/22/96		8/22/96		8/22/96		8/22/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
VOLATILE ORGANICS															
Benzene	60	NYSDEC TAGM	UG/KG	16	U	13	U	11	UJ	12	U	12	U	12	U
Toluene	1500	NYSDEC TAGM	UG/KG	16	U	13	UJ	11	UJ	12	U	12	U	12	U
SEMIVOLATILE ORGANICS															
2,4-Dinitrotoluene			UG/KG	450	U	410	U	370	U	380	U	390	U	390	U
2-Methylnaphthalene	36400	NYSDEC TAGM	UG/KG	450	UJ	410	U	370	U	380	U	390	U	390	U
2-Methylphenol	100	NYSDEC TAGM	UG/KG	450	U	410	U	370	U	380	U	390	U	390	U
Acenaphthene	50000	NYSDEC TAGM	UG/KG	450	U	410	U	370	U	18	J	390	U	390	U
Acenaphthylene	41000	NYSDEC TAGM	UG/KG	450	U	410	U	370	U	380	U	390	U	390	U
Anthracene	50000	NYSDEC TAGM	UG/KG	450	U	410	U	370	U	380	U	390	U	390	U
Benzo(a)anthracene	224	NYSDEC TAGM	UG/KG	450	U	410	U	39	J	85	J	57	J	52	J
Benzo(a)pyrene	61	NYSDEC TAGM	UG/KG	450	U	410	U	39	J	**110**	**J**	**69**	**J**	**62**	**J**
Benzo(b)fluoranthene	1100	NYSDEC TAGM	UG/KG	450	U	410	U	42	J	120	J	68	J	54	J
Benzo(g,h,i)perylene	50000	NYSDEC TAGM	UG/KG	450	U	410	U	35	J	130	J	65	J	55	J
Benzo(k)fluoranthene	1100	NYSDEC TAGM	UG/KG	450	U	410	U	47	J	94	J	65	J	61	J
Carbazole			UG/KG	450	UJ	410	U	370	UJ	380	U	390	U	390	U
Chrysene	400	NYSDEC TAGM	UG/KG	450	U	410	U	55	J	110	J	70	J	62	J
Di-n-butylphthalate	8100	NYSDEC TAGM	UG/KG	450	U	410	U	370	U	380	U	390	U	390	U
Dibenz(a,h)anthracene	14	NYSDEC TAGM	UG/KG	450	U	410	U	370	U	**54**	**J**	**34**	**J**	**30**	**J**
Dibenzofuran	6200	NYSDEC TAGM	UG/KG	450	U	410	U	370	U	380	U	390	U	390	U
Fluoranthene	50000	NYSDEC TAGM	UG/KG	450	U	410	U	70	J	160	J	110	J	93	J
Fluorene	50000	NYSDEC TAGM	UG/KG	450	U	410	U	370	U	380	U	390	U	390	U

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-13
SEAD-16 Summary of Analytes Detected in Downwind Surface Soil

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS16-500-N		SS16-500-S		1000-N		1000-S		2000-N		2000-N	
			SAMP ID:	16074		16086		16083		16087		16089		16090	
			QC CODE:	SA		SA		SA		SA		SA		DU	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/22/96		8/22/96		8/22/96		8/22/96		8/22/96		8/22/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Indeno(1,2,3-cd)pyrene	3200	NYSDEC TAGM	UG/KG	450	U	410	U	32	J	110	J	55	J	50	J
N-Nitrosodiphenylamine (1)			UG/KG	450	U	410	U	370	U	380	U	390	U	390	U
Naphthalene	13000	NYSDEC TAGM	UG/KG	450	U	410	U	370	U	380	U	390	U	390	U
Phenanthrene	50000	NYSDEC TAGM	UG/KG	450	U	410	U	34	J	90	J	36	J	35	J
Pyrene	50000	NYSDEC TAGM	UG/KG	22	J	410	U	76	J	160	J	92	J	81	J
PESTICIDES/PCB															
4,4'-DDE	2100	NYSDEC TAGM	UG/KG	4.5	U	4.1	U	5.2	J	1.9	J	3.9	U	3.9	U
4,4'-DDT	2100	NYSDEC TAGM	UG/KG	4.5	U	4.1	U	6	J	3.8	U	3.9	U	3.9	U
Dieldrin	44	NYSDEC TAGM	UG/KG	4.5	U	4.1	U	3.7	U	3.8	U	3.9	U	3.9	U
Endosulfan I	900	NYSDEC TAGM	UG/KG	2.3	U	2.1	U	1.6	J	2	U	2	U	2	U
Endosulfan sulfate	1000	NYSDEC TAGM	UG/KG	4.5	U	4.1	U	3.7	U	3.8	U	3.9	U	3.9	U
Endrin	100	NYSDEC TAGM	UG/KG	4.5	U	4.1	U	3.7	U	3.8	U	3.9	U	3.9	U
Endrin ketone			UG/KG	4.5	U	4.1	U	3.7	U	3.8	U	3.9	U	3.9	U
alpha-Chlordane			UG/KG	2.3	U	2.1	U	1.1	J	2	U	2	U	2	U
beta-BHC	200	NYSDEC TAGM	UG/KG	2.3	U	2.1	U	1.9	U	2	U	2	U	2	U
delta-BHC	300	NYSDEC TAGM	UG/KG	2.3	U	2.1	U	2.2		2	U	2	U	2	U
OTHER ANALYSES															
Nitrate/Nitrite-Nitrogen			MG/KG	0.16		0.35		0.34		0.27		6.1		6	
Percent Moisture (PEST/PCB)				27		19		11		14		16		16	
Percent Moisture (SVOCs)				27		19		11		14		16		16	
Percent Moisture (VOCs)				38		21		11		14		17		17	
Percent Solids (Metals)				73.4		80.6		88.7		86.1		83.5		83.6	

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-13
SEAD-16 Summary of Analytes Detected in Downwind Surface Soil

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS16-500-N		SS16-500-S		1000-N		1000-S		2000-N		2000-N	
			SAMP ID:	16074		16086		16083		16087		16089		16090	
			QC CODE:	SA		SA		SA		SA		SA		DU	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/22/96		8/22/96		8/22/96		8/22/96		8/22/96		8/22/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
NITROAROMATICS															
2,6-Dinitrotoluene	1000	NYSDEC TAGM	UG/KG	120	U	120	UJ	120	U	120	UJ	120	UJ	120	UJ
METALS															
Aluminum	14592.8	NYSDEC TAGM	MG/KG	14600	J	13200	J	13900	J	11600	J	11700	J	11500	J
Antimony	3.59	NYSDEC TAGM	MG/KG	0.54	UJ	0.88	J	0.7		0.8	J	0.39	U	0.45	U
Arsenic	7.5	NYSDEC TAGM	MG/KG	4.1		3.5	J	4.9		4.5	J	4.6	J	4.5	J
Barium	300	NYSDEC TAGM	MG/KG	128	J	143	J	81.8	J	90.3	J	113	J	109	J
Beryllium	0.73	NYSDEC TAGM	MG/KG	0.64		0.51		0.54		0.48		0.41		0.44	
Cadmium	1	NYSDEC TAGM	MG/KG	0.08	U	0.25		0.07		0.34		0.21		0.21	
Calcium	101904	NYSDEC TAGM	MG/KG	4280		6060		9650		14500		3410		3420	
Chromium	22.13	NYSDEC TAGM	MG/KG	20.5		17		24.4		18.5		14.8		14.8	
Cobalt	30	NYSDEC TAGM	MG/KG	8.5		9.2		15.7		9.2		7.2		7.1	
Copper	25	NYSDEC TAGM	MG/KG	25.4		20.8		39		21.2		17.9		17.7	
Iron	26626.7	NYSDEC TAGM	MG/KG	23400		21300		29300		22500		19100		19100	
Lead	21.86	NYSDEC TAGM	MG/KG	53.4		33.4		52		58		19.7		19.5	
Magnesium	12221.8	NYSDEC TAGM	MG/KG	3940		3850		6120		5330		3230		3200	
Manganese	669.38	NYSDEC TAGM	MG/KG	295	J	647		399	J	452		663		587	
Mercury	0.1	NYSDEC TAGM	MG/KG	0.16		0.05		0.06		0.06		0.07		0.09	
Nickel	33.62	NYSDEC TAGM	MG/KG	24.5		21.7		50.8		26.4		16.6		16.4	
Potassium	1761.48	NYSDEC TAGM	MG/KG	1200		901		1460		1100		1030		1060	
Selenium	2	NYSDEC TAGM	MG/KG	1.3	J	1.6		1.3	J	1.4		1.3		1.5	
Sodium	103.74	NYSDEC TAGM	MG/KG	73	U	56.3	U	83.1		59.2	U	51.7	U	59.9	U

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-13
SEAD-16 Summary of Analytes Detected in Downwind Surface Soil

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS16-500-N		SS16-500-S		1000-N		1000-S		2000-N		2000-N	
			SAMP ID:	16074		16086		16083		16087		16089		16090	
			QC CODE:	SA		SA		SA		SA		SA		DU	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/22/96		8/22/96		8/22/96		8/22/96		8/22/96		8/22/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Thallium	0.28	NYSDEC TAGM	MG/KG	1.1	U	0.88	U	0.88	U	0.93	U	0.81	U	0.94	U
Vanadium	150	NYSDEC TAGM	MG/KG	24.1		21.7		20.5		19		19.4		19.5	
Zinc	82.5	NYSDEC TAGM	MG/KG	**85.2**	**J**	56.4		**109**	**J**	**92.5**		55.8		55.8	

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-13
SEAD-16 Summary of Analytes Detected in Downwind Surface Soil

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	2000-S		3000-N		3000-S		3500-N		3500-S	
			SAMP ID:	16085		16088		16056		16084		16055	
			QC CODE:	SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/22/96		8/22/96		8/20/96		8/22/96		8/20/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
VOLATILE ORGANICS													
Benzene	60	NYSDEC TAGM	UG/KG	12	U	12	U	11	U	2	J	11	U
Toluene	1500	NYSDEC TAGM	UG/KG	12	U	12	U	11	U	3	J	2	J
SEMIVOLATILE ORGANICS													
2,4-Dinitrotoluene			UG/KG	410	U	380	U	380	U	880		400	
2-Methylnaphthalene	36400	NYSDEC TAGM	UG/KG	410	U	380	U	380	U	340	U	28	J
2-Methylphenol	100	NYSDEC TAGM	UG/KG	**120**	**J**	380	U	380	U	340	U	350	U
Acenaphthene	50000	NYSDEC TAGM	UG/KG	410	U	380	U	380	U	340	U	33	J
Acenaphthylene	41000	NYSDEC TAGM	UG/KG	410	U	380	U	380	U	96	J	35	J
Anthracene	50000	NYSDEC TAGM	UG/KG	410	U	380	U	380	U	110	J	130	J
Benzo(a)anthracene	224	NYSDEC TAGM	UG/KG	19	J	54	J	380	U	**720**		**480**	
Benzo(a)pyrene	61	NYSDEC TAGM	UG/KG	22	J	**73**	**J**	380	U	**940**		**640**	
Benzo(b)fluoranthene	1100	NYSDEC TAGM	UG/KG	410	U	58	J	380	U	**2200**	**J**	580	
Benzo(g,h,i)perylene	50000	NYSDEC TAGM	UG/KG	51	J	78	J	380	U	710		540	
Benzo(k)fluoranthene	1100	NYSDEC TAGM	UG/KG	38	J	73	J	380	U	340	U	530	
Carbazole			UG/KG	410	UJ	380	U	380	U	85	J	40	J
Chrysene	400	NYSDEC TAGM	UG/KG	25	J	69	J	380	U	**670**		**520**	
Di-n-butylphthalate	8100	NYSDEC TAGM	UG/KG	410	U	380	U	380	U	340	U	90	J
Dibenz(a,h)anthracene	14	NYSDEC TAGM	UG/KG	410	U	**39**	**J**	**18**	**J**	**470**		**200**	**J**
Dibenzofuran	6200	NYSDEC TAGM	UG/KG	410	U	380	U	380	U	340	U	36	J
Fluoranthene	50000	NYSDEC TAGM	UG/KG	36	J	100	J	380	U	1000		780	
Fluorene	50000	NYSDEC TAGM	UG/KG	410	U	380	U	380	U	340	U	38	J

Note: Shaded values exceed the NYSDEC TAGM.

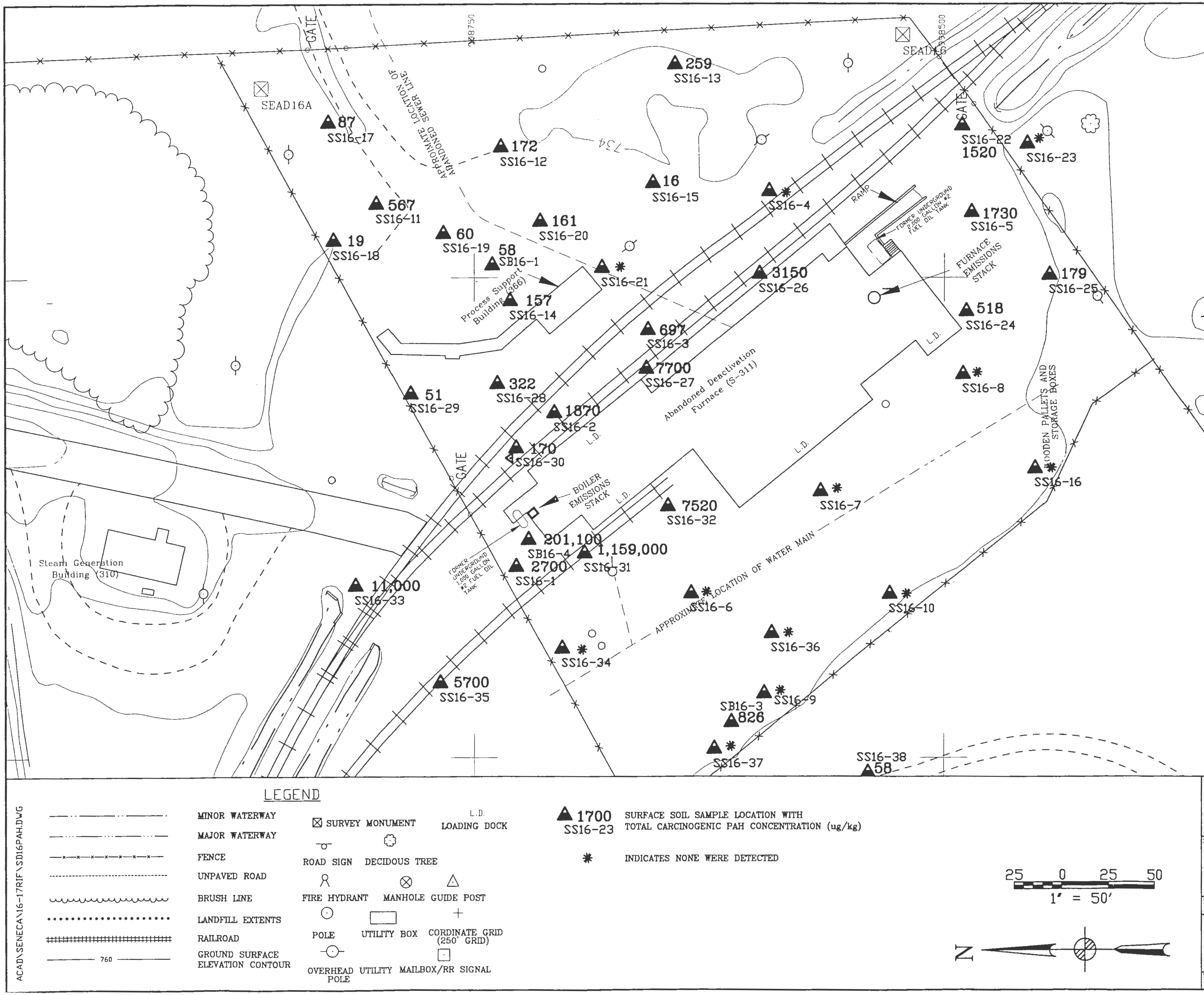
Table 4-13

SEAD-16 Summary of Analytes Detected in Downwind Surface Soil

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	2000-S		3000-N		3000-S		3500-N		3500-S	
			SAMP ID:	16085		16088		16056		16084		16055	
			QC CODE:	SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/22/96		8/22/96		8/20/96		8/22/96		8/20/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Thallium	0.28	NYSDEC TAGM	MG/KG	**0.83**		0.91	U	**1.2**		0.74	U	**1**	
Vanadium	150	NYSDEC TAGM	MG/KG	22.3		20.1		19		15.5		19.8	
Zinc	82.5	NYSDEC TAGM	MG/KG	78.7	J	68.2		**97.9**		53.2	J	**90.8**	

Note: Shaded values exceed the NYSDEC TAGM.



PARSONS

PARSONS ENGINEERING SCIENCE, INC.

CLIENT/PROJECT TITLE
SENECA ARMY DEPOT ACTIVITY
RI/FS
SEAD-16 ABANDONED DEACTIVATION FURNACE

DEPT	Dwg No.
ENVIRONMETAL ENGINEERING	729895-01001

FIGURE 4-1
SEAD-16 TOTAL CARCINOGENIC PAHs IN SURFACE SOIL

SCALE	DATE	REV.
1" = 50'	DECEMBER 1996	A

Table 4-14

SVOCs and TICs in Surface Soil (ug/Kg)

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Surface Soil Location	Surface Soil Sample ID	Study ID	Total TCL SVOCs	Total TICs	Total All SVOCs
SB16-1	16037	Round I	120	4081	4201
SB16-3	16032 (1)	Round I	1817	39590	41407
SB16-3	16033	Round I	880	75300	76180
SB16-4	16030	Round I	32260	26810	59070
SS16-1	SS16-1-1	ESI	8962	23670	32632
SS16-2	SS16-2-1	ESI	5988	6730	12718
SS16-3	SS16-3-1	ESI	12797	11890	24687
SS16-4	SS16-4-1	ESI	0	108900	108900
SS16-5	SS16-5-1	ESI	5411	17180	22591
SS16-6	SS16-6-1	ESI	0	189000	189000
SS16-7	SS16-7-1	ESI	0	757000	757000
SS16-8	SS16-8-1	ESI	1750	43850	45600
SS16-9	SS16-9-1	ESI	2770	124300	127070
SS16-10	SS16-10-1	ESI	120	53000	53120
SS16-11	SS16-11-1	ESI	2060	10130	12190
SS16-12	SS16-12-1	ESI	385	4810	5195
SS16-13	SS16-13-1	ESI	920	9090	10010
SS16-14	SS16-14-1	ESI	1223	3018	4241
SS16-15	SS16-15-1	ESI	83	2897	2980
SS16-16	SS16-16-1	ESI	0	65510	65510
SS16-17	16040	Round I	169	8850	9019
SS16-18	16041	Round I	88	10800	10888
SS16-19	16042	Round I	174	6098	6272
SS16-20	16043	Round I	680	5279	5959
SS16-21	16058	Round I	17800	8800	26600
SS16-21	16059 (2)	Round I	22300	10120	32420
SS16-22	16049	Round I	2704	15610	18314
SS16-23	16051	Round I	0	23150	23150
SS16-24	16060	Round I	4014	15350	19364
SS16-25	16050	Round I	398	2080	2478
SS16-26	16046	Round I	10031	26410	36441
SS16-27	16047	Round I	148800	6800	155600
SS16-28	16044	Round I	1185	7010	8195
SS16-29	16045	Round I	2305	4701	7006
SS16-30	16048	Round I	13029	94260	107289
SS16-31	16062	Round I	3133000	1233000	4366000
SS16-32	16052	Round I	11177	22660	33837
SS16-33	16067	Round I	20681	17590	38271
SS16-34	16053	Round I	0	123000	123000
SS16-35	16066	Round I	26952	28110	55062
SS16-36	16061	Round I	0	31780	31780
SS16-37	16054	Round I	0	27750	27750
SS16-38	16068	Round I	187	5631	5818
500S	16086	Round I	0	13540	13540
1000S	16087	Round I	1241	27230	28471
2000S	16085	Round I	369	9810	10179
3000S	16056	Round I	18	13070	13088
3500S	16055	Round I	6676	11830	18506
500N	16074	Round I	22	14120	14142
1000N	16083	Round I	469	17500	17969
2000N	16089	Round I	721	19080	19801
2000N	16090 (3)	Round I	635	NA	NA
3000N	16088	Round I	746	17500	18246
3500N	16084	Round I	10302	8180	18482

(1) Soil boring sample 16033 was a duplicate sample of 16032.

(2) Sample 16059 is a duplicate sample of 16058.

(3) Sample 16090 is a duplicate sample of 16089.

NA- Not Available

SB16-4 is located adjacent to the northwestern side of the Abandoned Deactivation Furnace Building. Among the PAHs, chrysene exceeded its TAGM the greatest number of times (17). The phenols did not exceed their respective TAGMs.

The detection limits for sample SB16-1 exceeded the respective TAGM values for the SVOC compounds benzo(a)anthracene, benzo(a)pyrene, and dibenz(a,h)anthracene. For samples SB16-4 and SB16-5, the detection limit exceeded the TAGM value for pentachlorophenol and slightly exceeded the TAGM value for 2,6-dinitrotoluene.

In addition to the NYSDEC TCL-listed SVOCs, TICs were estimated for the samples (Table 4-15). The highest concentration of TICs (191,320 µg/kg) was found in the sample from 2-4 feet at SB16-4. The sample from this location also contained the highest total SVOC concentration (217,380 µg/kg), which is the total of TCL-listed compounds and TICs. This concentration is not above the NYSDEC TAGM criteria value of 500,000 µg/kg for total SVOCs.

Downwind Surface Soils

Twenty-three SVOCs, mostly PAH compounds, were detected in the downwind surface soil samples. Six of the SVOCs were detected at concentrations exceeding their respective NYSDEC TAGM values. Five of the SVOCs were PAHs and one was a phenolic compound. Benzo(a)anthracene was detected in the two samples located 3,500 feet north and south of the site at concentrations above the NYSDEC TAGM value of 224 µg/kg. Its maximum concentration (720 µg/kg) was detected in sample 3500-N. Benzo(a)pyrene was detected in six samples at concentrations exceeding the NYSDEC TAGM value. Its two maximum concentrations of 940 µg/kg and 640 µg/kg were detected in the two samples located 3500 feet north and south of the site. Benzo(b)fluoranthene was found in only one sample, 3500-N, at a concentration above the TAGM value. Chrysene was found in two samples at concentrations above the NYSDEC TAGM value. Both exceedences were found in samples 3500-N and 3500-S. Dibenz(a,h)anthracene was detected in seven samples at concentrations above the TAGM value. The two maximum concentrations of this compound (470 µg/kg and 200 J µg/kg) were detected in samples 3500-N and 3000-S. The maximum total carcinogenic PAH concentrations were 5,790 µg/kg and 2,360 µg/kg, which were found in samples 3500-N and 3500-S, respectively.

4.1.4.3 Pesticide and PCBs

Surface Soils

Eighteen pesticides were detected in the surface soil samples from SEAD-16 (Table 4-9), however, all of the pesticides were detected at concentrations below their respective TAGM criteria. Two PCBs, Aroclor-1254 and Aroclor-1260, were detected in the surface soil samples at concentrations below their respective TAGM criteria for all samples except one. Aroclor-1254 was detected at 1,100 ug/kg at SS16-24, which is 100 ug/kg above its TAGM value of 1,000 ug/kg.

Detection limits for the pesticide and PCB compounds were below the respective TAGM values.

Subsurface Soils

A total of five pesticides were detected in the subsurface soil samples at SEAD-16 (Table 4-11). No PCBs were detected. Pesticides were detected in three of the six subsurface soil samples, however, at concentrations well below the respective TAGM values.

Detection limits for the pesticide and PCB compounds were below the respective TAGM values.

Downwind Surface Soils

A total of ten pesticides were detected in the downwind surface soil samples, however, all the pesticides were detected at concentrations below their respective NYSDEC TAGM values.

4.1.4.4 Nitroaromatics

Surface Soils

The four nitroaromatic compounds, 2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, and tetryl, were detected in the surface soil samples collected at SEAD-16. 2,4-Dinitrotoluene was detected in 27 of the 43 surface soil samples. The maximum concentration of 74,000 µg/kg was found in surface soil sample SS16-17, which is located in the northeastern corner of the site near the access road. Other high concentrations of this compound include 7,700 µg/kg found in SS16-21, which was located adjacent to the Process Support Building; 7,500 J µg/kg in SS16-27, which was located adjacent to the northeastern side of Building S-311. There is no NYSDEC TAGM criteria for this compound. 2,6-Dinitrotoluene was detected in three surface soil samples at a maximum concentration of 320 µg/kg, which is below the NYSDEC TAGM criteria of 1,000 µg/kg. The compound 2-amino-4,6-dinitrotoluene was

Table 4-15

SVOCs and TICs in Subsurface Soil (ug/Kg)

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Soil Boring Location	Soil Boring Sample ID	Study ID	Total SVOCs	Total TICs	Total All SVOCs
SB16-1	16093	Round I	330	6649	6979
SB16-1	16038	Round I	0	2546	2546
SB16-2	16036	Round I	3966	7640	11606
SB16-4	16031	Round I	26060	191320	217380
SB16-5	16034	Round I	78000	41800	119800
SB16-5	16035	Round I	2620	5121	7741

detected in only one surface soil sample (SS16-3) at a concentration of 430 J µg/kg; there is no NYSDEC TAGM criteria for this compound. Tetryl was detected in only one surface soil sample at a concentration of 220 J µg/kg in SS16-3. There is no NYSDEC TAGM criteria for this compound.

For the compound 2,6-dinitrotoluene, the detection limits were below the TAGM value for all samples except SS16-17.

Subsurface Soils

One nitroaromatic compound was detected in the subsurface soil samples from SEAD-16 (Table 4-11). The compound detected, 2,4-dinitrotoluene, was in three samples with the maximum concentration of 500 µg/kg found in soil sample SB16-4. There is no NYSDEC TAGM criteria value for this compound.

Downwind Surface Soils

One nitroaromatic compound was detected in the downwind surface soil samples. The compound, 2,6-dinitrotoluene, was detected in only one sample, 3500-S, at a concentration of 900 J µg/kg, which is below the NYSDEC TAGM value. Sample 3500-S was collected at a location 3500 feet south-southeast of the site.

4.1.4.5 Herbicides

The sixteen surface soil samples which were collected during the ESI were analyzed for herbicides; soil samples collected during the RI were not analyzed for herbicides. The two herbicides, 2,4,5-T and MCPP, were detected in the samples. 2,4,5-T was detected in two samples at concentrations below the NYSDEC TAGM criteria of 1,900 µg/kg. MCPP was detected in only one surface soil sample at a concentration of 16,000 µg/kg. There is no NYSDEC TAGM for this compound.

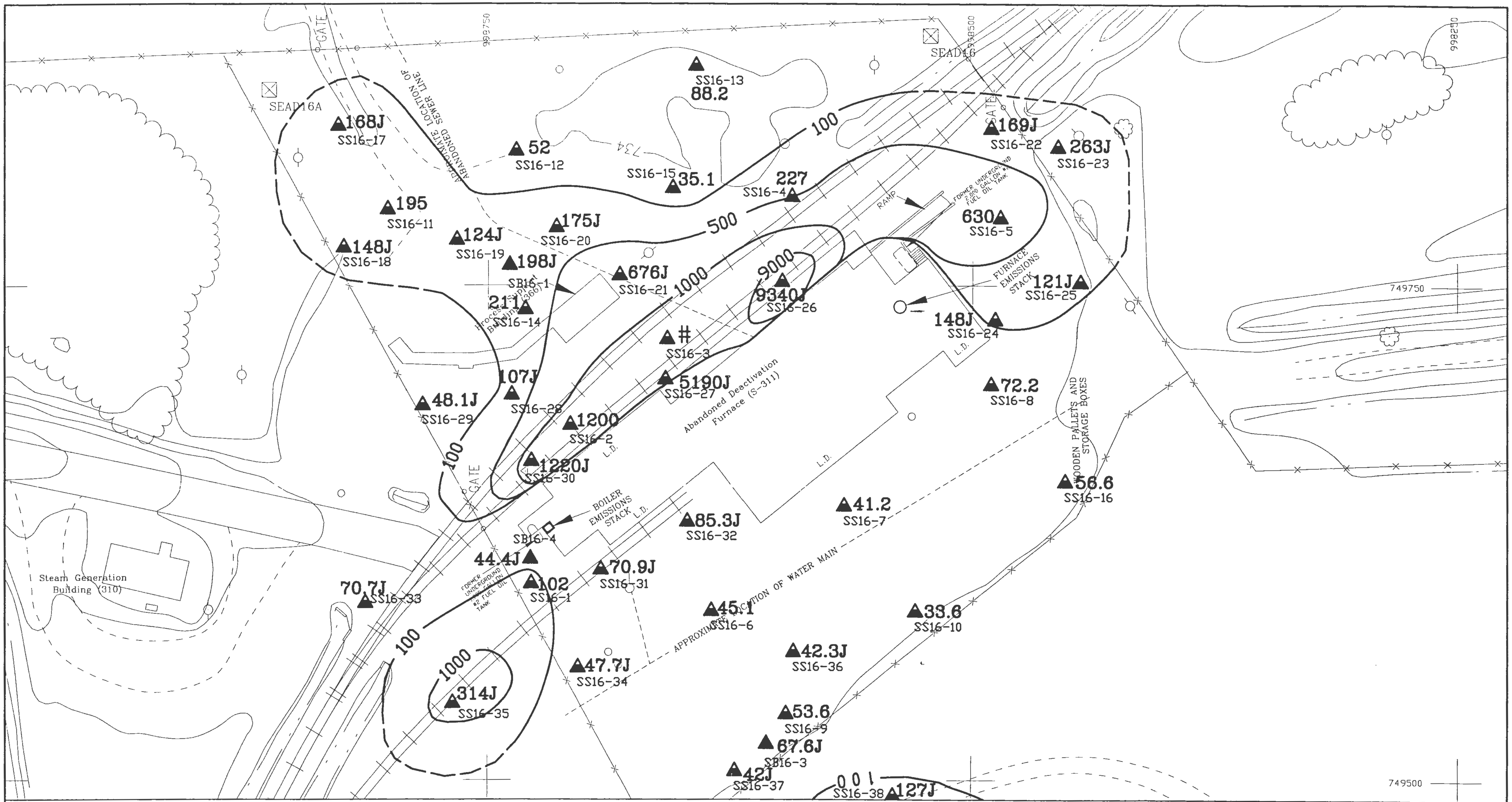
4.1.4.6 Metals

Surface Soils

Metals were detected in all 43 surface soil sample locations at the site (Table 4-9). Twenty-one metals were found at concentrations that exceeded their respective NYSDEC TAGM value. The metals that exceeded the standards are as follows: aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, copper, cyanide, iron, lead, magnesium, manganese, mercury, nickel, potassium, silver, sodium, thallium, and zinc. While all of the metals can occur naturally in soil, several of them are more common constituents of soil (i.e., aluminum, calcium, iron, magnesium, manganese, potassium and sodium) and are not considered to pose a significant health risk at SEAD-16. The remaining metals (i.e., antimony, arsenic, barium, beryllium, cadmium, chromium, copper, cyanide, lead, mercury, nickel, silver, thallium, and zinc) are considered to be more toxic and, therefore, are more pertinent to a discussion of significant impacts at the site.

Antimony was detected above the TAGM criteria in 16 of the 43 samples and its maximum concentration of 1,930 mg/kg was found in SS16-26. Arsenic was detected in all of the surface soil samples and ten of the samples contained concentrations of arsenic above the TAGM criteria. Its maximum concentration of 32.2 mg/kg was detected in SS16-27. Barium was detected in eight surface soil samples above the TAGM criteria. Barium's maximum concentration of 9,340 mg/kg was found in SS16-26. Figure 4-2 shows the distribution of barium in the surface soils. Beryllium was detected above the TAGM value in two of the 43 surface soil samples, and for both samples, the concentration only slightly exceeded the TAGM value of 0.73 mg/kg. Cadmium was detected in eight of the samples at concentrations above the TAGM value with a maximum concentration of 16.6 mg/kg found in SS16-27. Chromium was detected above its TAGM value in 18 of the 43 samples, however, in 12 of the samples, the concentrations only slightly exceeded the TAGM criteria of 22.13 mg/kg. The maximum concentration of 47.5 mg/kg was found at SS16-26. Copper was detected in all of the 43 surface soil samples with a maximum concentration of 37,900 mg/kg found in SS16-26. Cyanide was detected in only 1 sample at a concentration of 1.5 mg/kg found in SS16-35. Lead was detected in 41 of the samples above the TAGM; a maximum concentration of 140,000 mg/kg was found at SS16-26. Figure 4-3 shows the distribution of lead in the surface soils. Mercury exceeded the TAGM value of 0.1 mg/kg in 26 samples. The concentrations that exceeded the TAGM ranged from 0.1 mg/kg to 11.4 J mg/kg. Figure 4-4 shows the distribution of mercury in surface soils. Nickel was detected in 18 samples above the NYSDEC TAGM criteria. Except for the maximum concentration of 148 mg/kg, the concentrations of nickel were only slightly above the TAGM criteria. Silver was found in five samples above the NYSDEC TAGM criteria. The maximum concentration of 11.1 mg/kg was found in SS16-26. Thallium exceeded the NYSDEC TAGM criteria in 14 samples and the maximum concentration of 16.6 mg/kg in SS16-26 exceeded the TAGM value of 0.28 mg/kg. Lastly, zinc was found to exceed the TAGM criteria in 35 of the samples; its maximum concentration of 14,600 mg/kg was detected in sample SS16-26. Figure 4-5 shows the distribution of zinc in surface soils.

For the metals antimony, cyanide, and thallium, several samples had detection limits above the respective TAGM values. For antimony, ten of the 43 samples had detection limits above the TAGM value of 3.59 mg/kg. For cyanide, the detection limit was above the TAGM value of 0.3



ACAD\SENECA\16-17RIF\SD16BAR1.DWG

LEGEND

MINOR WATERWAY
MAJOR WATERWAY
FENCE
UNPAVED ROAD
BRUSH LINE
LANDFILL EXTENTS
RAILROAD
GROUND SURFACE ELEVATION CONTOUR (760)

⊠ SURVEY MONUMENT
L.D. LOADING DOCK
ROAD SIGN
DECIDOUS TREE
FIRE HYDRANT
MANHOLE
GUIDE POST
POLE
UTILITY BOX
CORDINATE GRID (250' GRID)
OVERHEAD UTILITY POLE
MAILBOX/RR SIGNAL

▲167J SS17-6 SURFACE SOIL SAMPLE WITH CHEMICAL CONCENTRATION

100 CHEMICAL CONCENTRATION CONTOURS (DASHED WHERE INFERED)

\# REJECTED DATA

25 0 25 50
1' = 50'

N

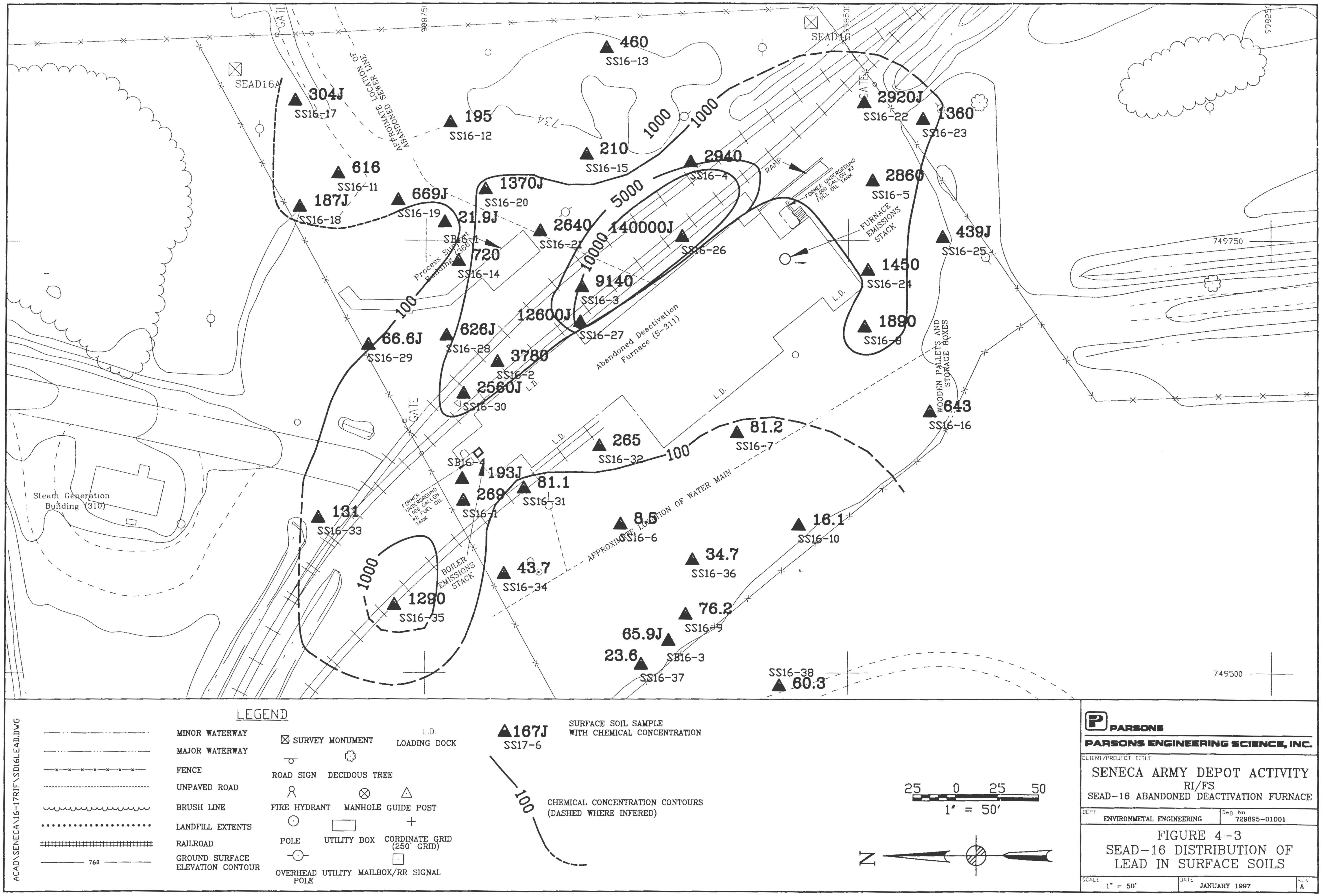
PARSONS
PARSONS ENGINEERING SCIENCE, INC.

SENECA ARMY DEPOT
RI/FS
SEAD-16 ABANDONED DEACTIVATION FURNACE

DEPT: ENVIRONMENTAL ENGINEERING
Dwg. No. 729895-01001

FIGURE 4-2
SEAD-16 DISTRIBUTION OF BARIUM IN SURFACE SOILS

SCALE: 1" = 50'
DATE: JANUARY 1997
REV: A



PARSONS

PARSONS ENGINEERING SCIENCE, INC.

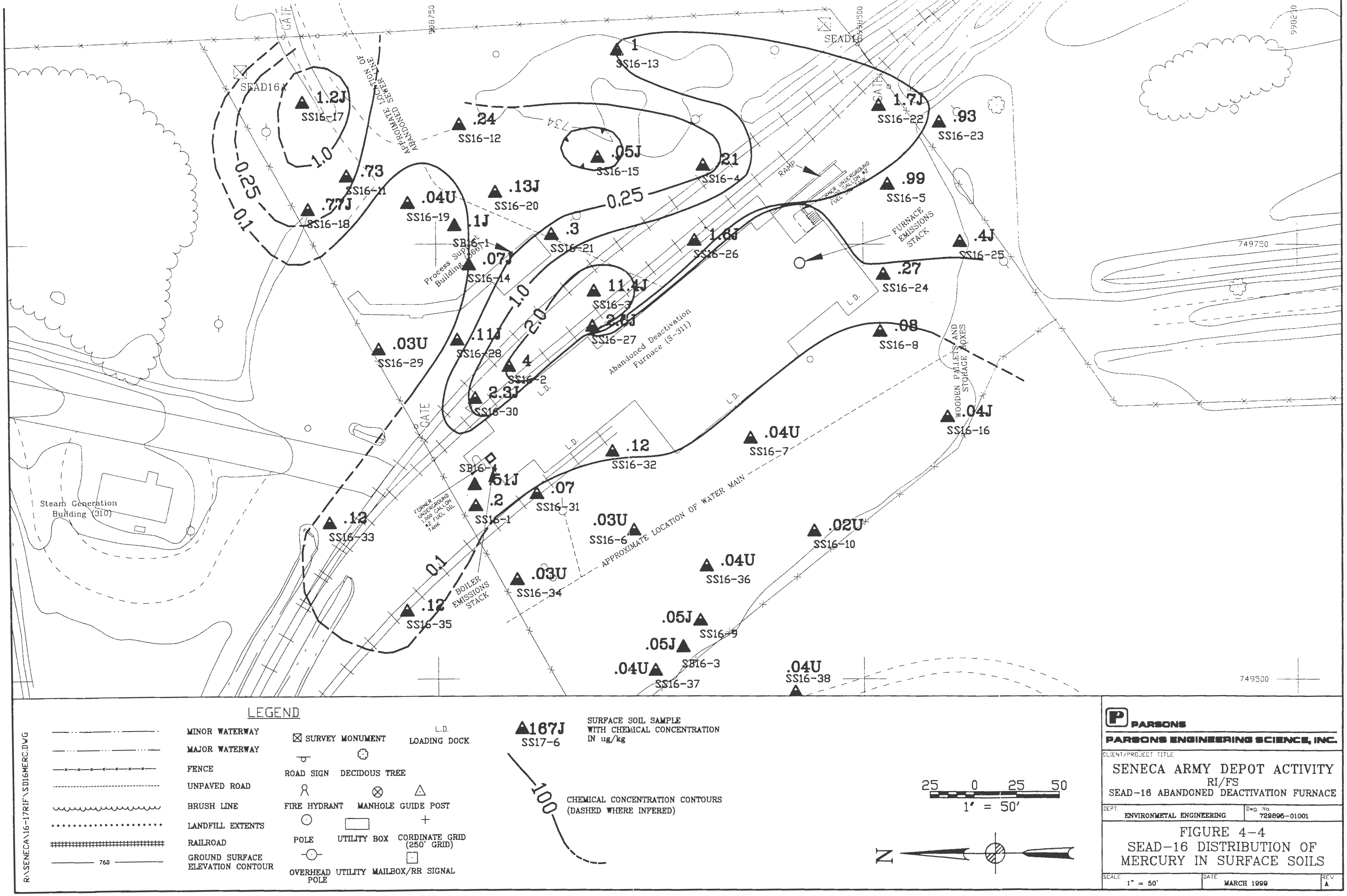
CLIENT/PROJECT TITLE

SENECA ARMY DEPOT ACTIVITY
RI/FS
SEAD-16 ABANDONED DEACTIVATION FURNACE

DEPT	Dwg No
ENVIRONMETAL ENGINEERING	729895-01001

FIGURE 4-3
SEAD-16 DISTRIBUTION OF
LEAD IN SURFACE SOILS

SCALE	DATE	REV
1" = 50'	JANUARY 1997	A



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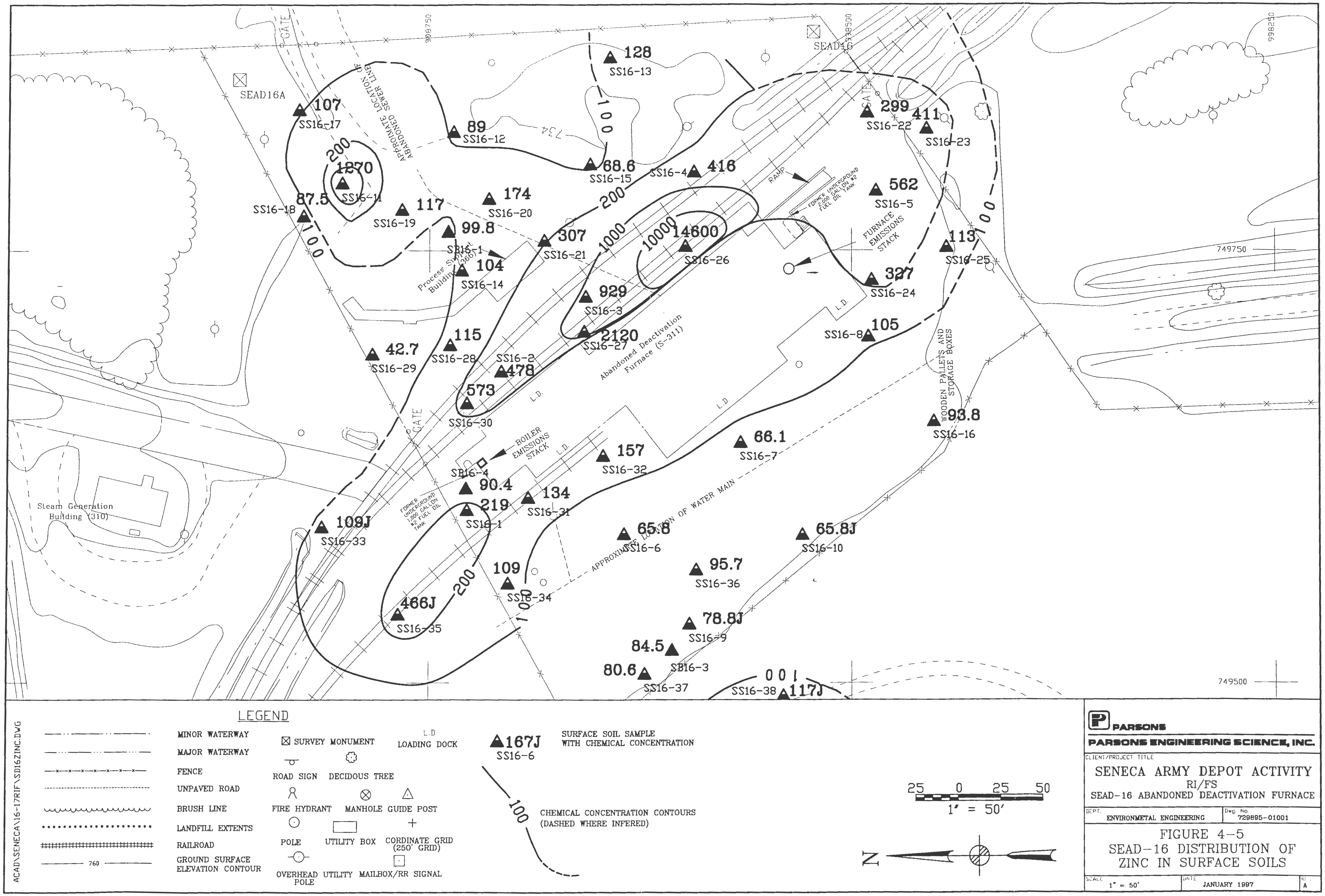
CLIENT/PROJECT TITLE

SENECA ARMY DEPOT ACTIVITY
RI/FS
SEAD-16 ABANDONED DEACTIVATION FURNACE

DEPT.	Dwg. No.
ENVIRONMETAL ENGINEERING	729896-01001

FIGURE 4-4
SEAD-16 DISTRIBUTION OF
MERCURY IN SURFACE SOILS

SCALE	DATE	REV
1" = 50'	MARCH 1999	A



PARSONS

PARSONS ENGINEERING SCIENCE, INC.

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT ACTIVITY
RI/FS
SEAD-16 ABANDONED DEACTIVATION FURNACE

DEPT.	Dwg No.
ENVIRONMETAL ENGINEERING	729895-01001

FIGURE 4-5
SEAD-16 DISTRIBUTION OF
ZINC IN SURFACE SOILS

SCALE	DATE	R
1" = 50'	JANUARY 1997	A

ACAD\SENECA16-17RIF\SD16ZINC.DWG

mg/kg. The maximum detection limit for this metal was 0.74 mg/kg. For thallium, the detection limit was elevated above the TAGM value of 0.28 mg/kg for 16 samples. The maximum detection limit was 1.6 mg/kg for this metal.

Subsurface Soils

Metals were detected in all six of the subsurface soil sample locations at the site (Table 4-11). Fourteen metals were found at concentrations that exceeded their respective NYSDEC TAGM values. The metals that exceeded the TAGM values are as follows: antimony, barium, copper, cyanide, iron, lead, magnesium, mercury, nickel, potassium, silver, sodium, thallium, and zinc. While all of the metals can occur naturally in soil, four of them are more common constituents of soil (i.e., iron, magnesium, potassium and sodium) and are generally considered to be less toxic than the others listed. The remaining metals (i.e., antimony, barium, copper, cyanide, lead, mercury, nickel, silver, thallium, and zinc) are considered to be more toxic and, therefore, are more pertinent to a discussion of significant impacts at the site.

Antimony exceeded the TAGM value in two of the six samples and its maximum concentration of 135 J mg/kg was found at SB16-5 at a depth of 1-2 feet. Barium was detected above the TAGM value in only one of the six samples, and the concentration only slightly exceeded the TAGM value of 300 mg/kg. Copper was detected above the TAGM value of 25 mg/kg in four out of the six samples. Copper's maximum concentrations was 736 mg/kg and 206 mg/kg. Cyanide was detected in only one of the six soil samples at a concentration of 0.52 J mg/kg, which was above the TAGM value of 0.3 mg/kg. Lead was detected in four of the samples above the TAGM value of 21.86 mg/kg. Its maximum concentration of 35,400 J mg/kg was found in the 1- to 2-foot sample at SB16-5, which is located adjacent to the southeastern side of the Abandoned Deactivation Furnace Building. Mercury exceeded its TAGM value of 0.1 mg/kg by approximately 19 times in the 1- to 2-foot sample of SB16-5. The TAGM for nickel was exceeded only slightly in two samples. Thallium also exceeded the TAGM value of 0.28 mg/kg in only one of the six samples with a maximum concentration of 0.91 mg/kg in SB16-2; this value exceeded the TAGM by three times. Lastly, zinc was found to exceed the TAGM value of 82.5 mg/kg in four samples; the maximum concentration of 183 mg/kg exceeded the TAGM by 2.2 times.

The group of metals consisting of iron, magnesium, potassium, and sodium are not considered to pose a significant health risk at SEAD-16, as these are common components of soil. None of these metals exceeded their respective TAGM values by more than 1.5 times and they represent a range of concentrations that approach background.

The soil samples from SB16-5 (1 to 2 feet) contained the highest concentration of metals and had the most NYSDEC TAGM exceedences. This soil boring is located at the southeastern side of the Abandoned Deactivation Furnace Building.

For the metals cyanide and thallium, the detection limits exceeded the respective TAGM values for most of the samples.

Downwind Surface Soils

Metals were detected in all eleven of the downwind surface soil samples collected for SEAD-16. Twelve metals were found at concentrations that exceeded their respective NYSDEC TAGM values. These metals are aluminum, calcium, chromium, copper, iron, lead, manganese, mercury, nickel, sodium, thallium, and zinc. Of these metals, chromium, copper, lead, mercury, nickel, thallium, and zinc are considered to be more toxic and will be discussed below.

Chromium was detected in only one sample at a concentration slightly above the TAGM value. Copper was detected in four samples at concentrations slightly above the TAGM value. Its maximum concentration of 39 mg/kg was found in sample 1000-N. Lead was detected in seven samples at concentrations above the NYSDEC TAGM value of 21.86 mg/kg. Lead's maximum concentration of 58 mg/kg was found in sample 1000-S. Mercury was detected in two samples at concentrations above the TAGM value and its maximum concentration of 0.56 mg/kg was detected in sample 3000-N. Nickel was detected in two samples above the TAGM value with the maximum concentration of 50.8 mg/kg found in sample 1000-N. Thallium was detected in three samples above the TAGM value with the maximum concentration of 1.2 mg/kg found in sample 3000-S. Zinc was found in five samples at concentrations slightly above the TAGM value. The maximum concentration of zinc (109 J mg/kg) was found in sample 1000-N.

4.1.4.7 Other Constituents

Nitrate/Nitrite-Nitrogen

Surface Soils

Nitrate/nitrite-nitrogen was detected at 42 of the 43 surface sample locations at concentrations ranging between 0.01 mg/kg and 4.8 mg/kg (Table 4-9). The highest of these concentrations was measured in the surface sample at SS16-30.

Subsurface Soils

Nitrate/nitrite-nitrogen was detected in all six of the subsurface samples at concentrations ranging between 0.09 mg/kg and 0.78 mg/kg (Table 4-11). The highest concentration was found in the sample from SB16-2 at a depth of 1-2 feet.

Downwind Surface Soils

Nitrate/nitrite-nitrogen was detected in all of the downwind surface soil samples at concentrations ranging from 0.06 mg/kg to 6.1 mg/kg.

4.1.5 Groundwater

A total of seven groundwater monitoring wells were installed at SEAD-16. Three monitoring wells, MW16-1, MW16-2, and MW16-3, were installed during the ESI field program and four additional monitoring wells, MW16-4 through MW16-7, were installed during the RI field program. Three rounds of groundwater sampling were conducted at SEAD-16. One round was conducted for the ESI in late 1993 and early 1994, a second in August 1996 as part of the RI, and a third in December 1996 as part of the RI at SEAD-16. Monitoring wells MW16-1, MW16-2, and MW16-3 were sampled three times; the four monitoring wells installed during the RI were sampled twice, except for monitoring well MW16-5 which was dry at the time of sampling in August 1996.

The discussion below will focus on the more recent groundwater data collected from the wells during the RI (August 1996 and December 1996) because this data depicts the most recent groundwater conditions at SEAD-16, and represents a larger database since several of the wells were not installed for the ESI. Furthermore, the low-flow groundwater sampling method was implemented during the RI field program and resulted in low turbidity groundwater samples, which are more representative of the groundwater at the site.

Groundwater results were compared to the lowest value from the following criteria: New York State Class GA standards, Federal Drinking Water Standards Maximum Contaminant Levels (MCLs) and secondary MCLs.

Summary statistics for the groundwater analyses are shown in Table 4-16.

4.1.5.1 Volatile Organic Compounds

Groundwater Sampling Round 1 - August 1996

No VOCs were detected in the six monitoring wells sampled at the site (Table 4-17).

In addition to the NYSDEC TCL-listed VOCs, TICs were estimated for the groundwater samples (Table 4-18). TICs were found in three monitoring wells that were sampled for Round 1 of the RI. The highest concentration of TICs (1.6 µg/L) was found in the MW16-2.

Groundwater Sampling Round 2 - December 1996

No VOCs were detected in the seven monitoring wells sampled at the site (Table 4-17).

No TICs were found in the monitoring wells that were sampled for Round 2.

4.1.5.2 Semivolatile Organic Compounds (SVOCs)

Groundwater Sampling Round 1 - August 1996

SVOCs were detected in two of the six monitoring wells sampled at the site during the RI (Table 4-17). A total of six compounds, including three PAHs, were detected in the two wells, MW16-3 and MW16-7. New York State Class GA water quality standards were exceeded in only one well, MW16-7, in which 4-chloroaniline was detected at a concentration of 10 J µg/L. MW16-7 is located on the southeastern side of the Abandoned Deactivation Furnace.

The highest concentration of TICs for SVOCs in groundwater was found in well MW16-1 (188 µg/L). Low concentration of other TICs were found in one of the other wells sampled during Round 1 (Table 4-19).

The NYS Class GA Standard for 4-chloroaniline (5 µg/L) was exceeded by the detection limit for all of the samples. The detection limits were 10 µg/L and 11 µg/L.

Groundwater Sampling Round 2 - December 1996

No SVOCs were detected in the seven monitoring wells sampled at the site.

The highest concentration of TICs for SVOCs in groundwater was found in well MW16-1 (35 µg/L).

4.1.5.3 Pesticide and PCBs

Groundwater Sampling Round 1 - August 1996

No pesticides or PCBs were found in any of the groundwater samples collected from the six monitoring wells sampled at SEAD-16.

Table 4-16
SEAD-16 Summary Statistics of Groundwater Samples from Rounds 1 and 2 of Remedial Investigation

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
VOLATILE ORGANICS								
1,1,1,2-Tetrachloroethane	UG/L	15	0	0%				
1,1,1-Trichloroethane	UG/L	15	0	0%				
1,1,2,2-Tetrachloroethane	UG/L	15	0	0%				
1,1,2-Trichloroethane	UG/L	15	0	0%				
1,1-Dichloroethane	UG/L	15	0	0%				
1,1-Dichloroethene	UG/L	15	0	0%				
1,1-Dichloropropene	UG/L	15	0	0%				
1,2,3-Trichlorobenzene	UG/L	15	0	0%				
1,2,3-Trichloropropane	UG/L	15	0	0%				
1,2,4-Trichlorobenzene	UG/L	15	0	0%				
1,2,4-Trimethylbenzene	UG/L	15	0	0%				
1,2-Dibromo-3-Chloropropane	UG/L	15	0	0%				
1,2-Dibromoethane	UG/L	15	0	0%				
1,2-Dichlorobenzene	UG/L	15	0	0%				
1,2-Dichloroethane	UG/L	15	0	0%				
1,2-Dichloropropane	UG/L	15	0	0%				
1,3,5-Trimethylbenzene	UG/L	15	0	0%				
1,3-Dichlorobenzene	UG/L	15	0	0%				
1,4-Dichlorobenzene	UG/L	15	0	0%				
1,4-Dioxane	UG/L	15	0	0%				
2,2-Dichloropropane	UG/L	15	0	0%				
2-Butanone	UG/L	15	0	0%				
2-Chlorotoluene	UG/L	15	0	0%				
2-Hexanone	UG/L	15	0	0%				
4-Chlorotoluene	UG/L	15	0	0%				
4-Methyl-2-Pentanone	UG/L	15	0	0%				
Acetone	UG/L	15	0	0%				
Benzene	UG/L	15	0	0%				
Bromobenzene	UG/L	15	0	0%				
Bromochloromethane	UG/L	15	0	0%				
Bromodichloromethane	UG/L	15	0	0%				
Bromoform	UG/L	15	0	0%				
Bromomethane	UG/L	15	0	0%				
Carbon Disulfide	UG/L	15	0	0%				
Carbon Tetrachloride	UG/L	15	0	0%				
Chlorobenzene	UG/L	15	0	0%				
Chloroethane	UG/L	15	0	0%				
Chloroform	UG/L	15	0	0%				
Chloromethane	UG/L	15	0	0%				
Dibromochloromethane	UG/L	15	0	0%				

Table 4-16
SEAD-16 Summary Statistics of Groundwater Samples
from Rounds 1 and 2 of Remedial Investigation

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Parameter	**Units**	**Total Count**	**Hit Count**	**Frequency**	**Min. Conc.**	**Max. Conc.**	**Average**	**Standard Deviation**
Dibromomethane	UG/L	15	0	0%				
Dichlorodifluromethane	UG/L	15	0	0%				
Ethylbenzene	UG/L	15	0	0%				
Hexachlorobutadiene	UG/L	15	0	0%				
Isopropylbenzene	UG/L	15	0	0%				
Methylene Chloride	UG/L	15	0	0%				
Naphthalene	UG/L	15	0	0%				
Styrene	UG/L	15	0	0%				
Tetrachloroethene	UG/L	15	0	0%				
Tetrahydrofuran	UG/L	15	0	0%				
Toluene	UG/L	15	0	0%				
Trichloroethene	UG/L	15	0	0%				
Trichlorofluoromethane	UG/L	15	0	0%				
Vinyl Chloride	UG/L	15	0	0%				
Xylene (total)	UG/L	15	0	0%				
cis-1,2-Dichloroethane	UG/L	15	0	0%				
cis-1,3-Dichloropropene	UG/L	15	0	0%				
n-Butylbenzene	UG/L	15	0	0%				
n-Propylbenzene	UG/L	15	0	0%				
p-Isopropyltoluene	UG/L	15	0	0%				
sec-Butylbenzene	UG/L	15	0	0%				
tert-Butylbenzene	UG/L	15	0	0%				
trans-1,2-Dichloroethene	UG/L	15	0	0%				
trans-1,3-Dichloropropene	UG/L	15	0	0%				
SEMIVOLATILE ORGANICS								
1,2,4-Trichlorobenzene	UG/L	15	0	0%				
1,2-Dichlorobenzene	UG/L	15	0	0%				
1,3-Dichlorobenzene	UG/L	15	0	0%				
1,4-Dichlorobenzene	UG/L	15	0	0%				
2,4,5-Trichlorophenol	UG/L	15	0	0%				
2,4,6-Trichlorophenol	UG/L	15	0	0%				
2,4-Dichlorophenol	UG/L	15	0	0%				
2,4-Dimethylphenol	UG/L	15	0	0%				
2,4-Dinitrophenol	UG/L	15	0	0%				
2,4-Dinitrotoluene	UG/L	15	0	0%				
2,6-Dinitrotoluene	UG/L	15	0	0%				
2-Chloronaphthalene	UG/L	15	0	0%				
2-Chlorophenol	UG/L	15	0	0%				
2-Methylnaphthalene	UG/L	15	0	0%				
2-Methylphenol	UG/L	15	0	0%				
2-Nitroaniline	UG/L	15	0	0%				

Table 4-16
SEAD-16 Summary Statistics of Groundwater Samples from Rounds 1 and 2 of Remedial Investigation

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
Phenanthrene	UG/L	15	0	0%				
Phenol	UG/L	15	0	0%				
Pyrene	UG/L	15	0	0%				
bis(2-Chloroethoxy) methane	UG/L	15	0	0%				
bis(2-Chloroethyl) ether	UG/L	15	0	0%				
bis(2-Chloroisopropyl) ether	UG/L	15	0	0%				
bis(2-Ethylhexyl)phthalate	UG/L	15	0	0%				
PESTICIDES/PCB								
4,4'-DDD	UG/L	15	0	0%				
4,4'-DDE	UG/L	15	0	0%				
4,4'-DDT	UG/L	15	0	0%				
Aldrin	UG/L	15	0	0%				
Aroclor-1016	UG/L	15	0	0%				
Aroclor-1221	UG/L	15	0	0%				
Aroclor-1232	UG/L	15	0	0%				
Aroclor-1242	UG/L	15	0	0%				
Aroclor-1248	UG/L	15	0	0%				
Aroclor-1254	UG/L	15	0	0%				
Aroclor-1260	UG/L	15	0	0%				
Dieldrin	UG/L	15	0	0%				
Endosulfan I	UG/L	15	0	0%				
Endosulfan II	UG/L	15	0	0%				
Endosulfan sulfate	UG/L	15	0	0%				
Endrin	UG/L	15	0	0%				
Endrin aldehyde	UG/L	15	0	0%				
Endrin ketone	UG/L	15	0	0%				
Heptachlor	UG/L	15	0	0%				
Heptachlor epoxide	UG/L	15	0	0%				
Methoxychlor	UG/L	15	0	0%				
Toxaphene	UG/L	15	0	0%				
alpha-BHC	UG/L	15	0	0%				
alpha-Chlordane	UG/L	15	0	0%				
beta-BHC	UG/L	15	0	0%				
delta-BHC	UG/L	15	0	0%				
gamma-BHC (Lindane)	UG/L	15	0	0%				
gamma-Chlordane	UG/L	15	0	0%				
OTHER ANALYSES								
Nitrate/Nitrite-Nitrogen	MG/L	15	12	80%	0.02	2	0.561	0.604
Percent Solids (Metals)		15	15	100%	0	0	0	0
Total Petroleum Hydrocarbons	MG/L	15	6	40%	0.73	1.3	1.022	0.233
NITROAROMATICS								

Table 4-16
SEAD-16 Summary Statistics of Groundwater Samples from Rounds 1 and 2 of Remedial Investigation

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Parameter	**Units**	**Total Count**	**Hit Count**	**Frequency**	**Min. Conc.**	**Max. Conc.**	**Average**	**Standard Deviation**
1,3,5-Trinitrobenzene	UG/L	15	0	0%				
1,3-Dinitrobenzene	UG/L	15	2	13%	0.26	1.8	1.03	1.089
2,4,6-Trinitrotoluene	UG/L	15	0	0%				
2,4-Dinitrotoluene	UG/L	15	1	7%	0.68	0.68	0.68	0
2,6-Dinitrotoluene	UG/L	15	0	0%				
2-amino-4,6-Dinitrotoluene	UG/L	15	0	0%				
4-amino-2,6-Dinitrotoluene	UG/L	15	0	0%				
HMX	UG/L	15	0	0%				
Nitrobenzene	UG/L	15	0	0%				
RDX	UG/L	15	0	0%				
Tetryl	UG/L	15	0	0%				
METALS								
Aluminum	UG/L	15	8	53%	12.4	1850	675.163	692.179
Antimony	UG/L	15	2	13%	7.5	12.3	9.9	3.394
Arsenic	UG/L	15	1	7%	3.2	3.2	3.2	0
Barium	UG/L	15	7	47%	48.1	97.4	76.243	16.634
Beryllium	UG/L	15	6	40%	0.15	0.23	0.205	0.028
Cadmium	UG/L	15	1	7%	0.32	0.32	0.32	0
Calcium	UG/L	15	15	100%	44600	193000	116960	38213.12
Chromium	UG/L	15	5	33%	1	3.4	2.18	0.952
Cobalt	UG/L	15	5	33%	1.2	2.1	1.52	0.37
Copper	UG/L	15	7	47%	3.6	56.8	14.557	19.392
Cyanide	UG/L	15	0	0%				
Iron	UG/L	15	14	93%	23.4	2400	640.471	783.907
Lead	UG/L	15	7	47%	5.9	24.1	10.057	6.38
Magnesium	UG/L	15	15	100%	6370	23700	16791.33	5871.808
Manganese	UG/L	15	14	93%	43.2	1380	215.2	359.396
Mercury	UG/L	15	0	0%				
Nickel	UG/L	15	7	47%	2.2	11	4.757	3.092
Potassium	UG/L	15	8	53%	1670	18800	5216.25	5563.809
Selenium	UG/L	15	1	7%	2.8	2.8	2.8	0
Silver	UG/L	15	0	0%				
Sodium	UG/L	15	14	93%	6740	409000	70347.86	141144.3
Thallium	UG/L	15	4	27%	4.2	11	7.65	3.035
Vanadium	UG/L	15	5	33%	1.2	3.8	2.82	0.978
Zinc	UG/L	15	1	7%	42	42	42	0

Table 4-17
SEAD-16 Summary of Analytes Detected in Groundwater

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

		LOC_ID:		MW16-1		MW16-1		MW16-1		MW16-2		MW16-2		MW16-2		MW16-2	
		SAMP ID:		MW16-1-1		16101		16152		MW16-2-1		MW16-41-1		16102		16150	
		QC CODE:		SA		SA		SA		SA		DU		SA		SA	
		STUDY ID:		ESI		RI ROUND1		RI ROUND2		ESI		ESI		RI ROUND1		RI ROUND2	
		MATRIX:		WATER		WATER		WATER		WATER		WATER		WATER		WATER	
		SAMPLE DATE:		11/19/93		8/27/96		12/7/96		11/19/93		11/19/93		8/27/96		12/6/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
SEMIVOLATILE ORGANICS																	
3-Nitroaniline			UG/L	27	U	26	UJ	25	U	27	U	27	U	25	U	25	U
4-Chloroaniline	5	NYS CLASS GA STANDARD	UG/L	11	U	10	UJ	10	U	11	U	11	U	10	U	10	U
Benzo[ghi]perylene			UG/L	11	U	10	UJ	10	U	11	U	11	U	10	U	10	U
Dibenz[a,h]anthracene			UG/L	11	U	10	UJ	10	U	11	U	11	U	10	U	10	U
Diethyl phthalate			UG/L	11	U	10	UJ	10	U	11	U	11	U	10	U	10	U
Indeno[1,2,3-cd]pyrene			UG/L	11	U	10	UJ	10	U	11	U	11	U	10	U	10	U
OTHER ANALYSES																	
Nitrate/Nitrite Nitrogen			MG/L	0.11		0.02		0.01	U	0.86		0.77		0.67		2	
Percent Solids (Metals)						0		0						0		0	
Total Petroleum Hydrocarbons			MG/L			0.44	U	0.4	U					0.4	U	0.36	U
NITROAROMATICS																	
1,3-Dinitrobenzene	5	NYS CLASS GA STANDARD	UG/L	0.13	U	0.26	U	0.26	U	0.13	U	0.13	U	1.8	J	0.26	U
2,4-Dinitrotoluene	5	NYS CLASS GA STANDARD	UG/L	0.13	U	0.26	U	0.26	U	0.13	U	0.13	U	0.26	U	0.26	U
METALS																	
Aluminum	200	EPA SECONDARY MCL	UG/L	**53600**		**1850**		143	U	**3500**		**4540**		**1010**		**490**	
Antimony	6	EPA MCL	UG/L	52.5	U	2	U	3	U	52.4	U	52.7	U	2	U	3	U
Arsenic	25	NYS CLASS GA STANDARD	UG/L	15.4		2.7	U	4.4	U	1	U	1.3	J	2.7	U	4.4	U
Barium	1000	NYS CLASS GA STANDARD	UG/L	401		74.2		48.2	U	43	J	48.4	J	48.1		31.4	U
Beryllium	4	EPA MCL	UG/L	3.1	J	0.23		0.2	U	0.3	U	0.3	U	0.22		0.2	U
Cadmium	5	EPA MCL	UG/L	3.3	U	0.3	U	0.6	U	3.3	U	3.3	U	0.3	U	0.6	U
Calcium			UG/L	239000		157000		116000		114000		117000		193000		164000	
Chromium	50	NYS CLASS GA STANDARD	UG/L	**88.5**		2.7		1	U	6	J	6.9	J	2.3		1.1	U
Cobalt			UG/L	59.9		2.1		1.3	U	4.9	U	4.9	U	1.5		1.3	U
Copper	200	NYS CLASS GA STANDARD	UG/L	64.2		4.9		1.9	U	12.1	J	14.8	J	7.9		2.9	U
Iron	300	NYS CLASS GA STANDARD	UG/L	**88100**		**2400**	**J**	296		**5310**		**6400**		**1720**	**J**	**923**	**J**
Lead	15	EPA MCL	UG/L	**71.1**		1.7	U	1.5	U	**27.3**		**34.5**		5.9		6.8	
Magnesium			UG/L	42000		23300		17600		15200		15900		23700		20900	
Manganese	50	EPA SECONDARY MCL	UG/L	**2110**		**210**		**64.2**		**167**		**189**		**129**		**65.2**	
Mercury	2	NYS CLASS GA STANDARD	UG/L	0.07	UJ	0.1	U	0.1	U	0.07	UJ	0.07	UJ	0.1	U	0.1	U
Nickel	100	EPA MCL	UG/L	**135**		4.7		2.5	U	10.2	J	11.5	J	11		3.1	U
Potassium			UG/L	10200		1670		998	U	4810	J	4520	J	4760		3410	U

Note: Shaded values exceed the NYS Class GA Standard or EPA MCL

Table 4-17
SEAD-16 Summary of Analytes Detected in Groundwater

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

		LOC ID:		MW16-1		MW16-1		MW16-1		MW16-2		MW16-2		MW16-2		MW16-2	
		SAMP ID:		MW16-1-1		16101		16152		MW16-2-1		MW16-41-1		16102		16150	
		QC CODE:		SA		SA		SA		SA		DU		SA		SA	
		STUDY ID:		ESI		RI ROUND1		RI ROUND2		ESI		ESI		RI ROUND1		RI ROUND2	
		MATRIX:		WATER		WATER		WATER		WATER		WATER		WATER		WATER	
		SAMPLE DATE:		11/19/93		8/27/96		12/7/96		11/19/93		11/19/93		8/27/96		12/6/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Selenium	10	NYS CLASS GA STANDARD	UG/L	2.5	J	2.4	U	4.7	UJ	0.8	U	0.99	J	2.4	U	4.7	UJ
Sodium	20000	NYS CLASS GA STANDARD	UG/L	7710		8750		3870	U	11400		11700		19100		17000	
Thallium	2	EPA MCL	UG/L	1.8	U	4.2	U	5.9	U	1.8	U	1.8	U	**9.2**		9.6	U
Vanadium			UG/L	86.5		3.3		1.6	U	7.2	J	9.3	J	2.9		1.6	U
Zinc	300	NYS CLASS GA STANDARD	UG/L	**460**		15.6	R	5.8	U	30.4		33.4		37.4	R	13.5	U

Note: Shaded values exceed the NYS Class GA Standard or EPA MCL

Table 4-17
SEAD-16 Summary of Analytes Detected in Groundwater

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

		LOC ID:		MW16-3		MW16-3		MW16-3		MW16-3		MW16-4		MW16-4		MW16-5	
		SAMP ID:		MW16-3-1		16110		16115		16165		16105		16156		16162	
		QC CODE:		SA		SA		SA		SA		SA		SA		SA	
		STUDY ID:		ESI		RI ROUND1		RI ROUND1		RI ROUND2		RI ROUND1		RI ROUND2		RI ROUND2	
		MATRIX:		WATER		WATER		WATER		WATER		WATER		WATER		WATER	
		SAMPLE DATE:		11/19 93		8/30/96		9/10/96		12/10/96		8/28/96		12/7/96		12/9/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
SEMIVOLATILE ORGANICS																	
3-Nitroaniline			UG/L	27	U	25	U	25	U	25	U	26	U	25	U	25	U
4-Chloroaniline	5	NYS CLASS GA STANDARD	UG/L	11	U	10	U	10	U	10	U	10	U	10	U	10	U
Benzo[ghi]perylene			UG/L	11	U	1	J	10	U	10	U	10	U	10	U	10	U
Dibenz[a,h]anthracene			UG/L	11	U	0.7	J	10	U	10	U	10	U	10	U	10	U
Diethyl phthalate			UG/L	0.5	J	10	U	10	U	10	U	10	U	10	U	10	U
Indeno[1,2,3-cd]pyrene			UG/L	11	U	0.6	J	10	U	10	U	10	U	10	U	10	U
OTHER ANALYSES																	
Nitrate/Nitrite Nitrogen			MG/L	0.23		0.04		0.11		0.64		0.29		0.26		1.4	
Percent Solids (Metals)						0		0		0		0		0		0	
Total Petroleum Hydrocarbons			MG/L			0.41	U	1.3		1		0.41	U	0.42	U	0.91	
NITROAROMATICS																	
1,3-Dinitrobenzene	5	NYS CLASS GA STANDARD	UG/L	0.13	U	0.26	U	0.26	U	0.26	U	0.26	U	0.26	U	0.26	U
2,4-Dinitrotoluene	5	NYS CLASS GA STANDARD	UG/L	0.07	J	0.26	U	0.26	U	0.26	U	0.68	J	0.26	U	0.26	U
METALS																	
Aluminum	200	EPA SECONDARY MCL	UG/L	**149000**		**336**		**1470**		36.1	U	24.9		36.1	U	148	U
Antimony	6	EPA MCL	UG/L	**89.6**		**7.5**		**12.3**		5.3	U	2	U	3	U	3	U
Arsenic	25	NYS CLASS GA STANDARD	UG/L	**33.2**		2.7	U	3.2		4.4	U	2.7	U	4.4	U	4.4	U
Barium	1000	NYS CLASS GA STANDARD	UG/L	**1170**		64.4		74		57.4	U	97.4		55.2	U	67.6	U
Beryllium	4	EPA MCL	UG/L	**8.1**		0.21		0.15		0.2	U	0.21		0.2	U	0.2	U
Cadmium	5	EPA MCL	UG/L	3.9	J	0.3	U	0.32		0.6	U	0.3	U	0.6	U	0.6	U
Calcium			UG/L	477000		99800		91600		85500		130000		158000		90000	
Chromium	50	NYS CLASS GA STANDARD	UG/L	**293**		1	U	3.4		1	U	1	U	1	U	1	U
Cobalt			UG/L	166		1.2	U	1.6		1.3	U	1.2	U	1.3	U	1.3	U
Copper	200	NYS CLASS GA STANDARD	UG/L	**2150**		19.2		56.8		11.4	U	3.6		1.1	U	1.1	U
Iron	300	NYS CLASS GA STANDARD	UG/L	**246000**		**432**	**J**	**1900**	**J**	77.8	U	38.2		126		211	
Lead	15	EPA MCL	UG/L	**3240**		6.1		**24.1**	**J**	1.5	U	1.7	U	1.5	U	3	U
Magnesium			UG/L	92000		11600		10500		10000		17700		22900		11800	
Manganese	50	EPA SECONDARY MCL	UG/L	**6300**		**130**		**66.3**		5.9	U	**132**		**66.9**		**51**	
Mercury	2	NYS CLASS GA STANDARD	UG/L	**3.9**	**J**	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Nickel	100	EPA MCL	UG/L	**406**		3		6.1		2.5	U	2.2		2.5	U	2.5	U
Potassium			UG/L	24800		2740		2970		1900	U	4040		1660	U	18800	

Note Shaded values exceed the NYS Class GA Standard or EPA MCL.

Table 4-17
SEAD-16 Summary of Analytes Detected in Groundwater

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

		LOC ID:		MW16-3		MW16-3		MW16-3		MW16-3		MW16-4		MW16-4		MW16-5	
		SAMP ID:		MW16-3-1		16110		16115		16165		16105		16156		16162	
		QC CODE:		SA		SA		SA		SA		SA		SA		SA	
		STUDY ID:		ESI		RI ROUND1		RI ROUND1		RI ROUND2		RI ROUND1		RI ROUND2		RI ROUND2	
		MATRIX:		WATER		WATER		WATER		WATER		WATER		WATER		WATER	
		SAMPLE DATE:		11/19/93		8/30/96		9/10/96		12/10/96		8/28/96		12/7/96		12/9/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Selenium	10	NYS CLASS GA STANDARD	UG/L	**10.3**		2.4	U	2.8		4.7	UJ	2.4	U	4.7	UJ	4.7	UJ
Sodium	20000	NYS CLASS GA STANDARD	UG/L	10500		9480		6740		7660		17200		12300		**49500**	
Thallium	2	EPA MCL	UG/L	17.8	U	4.2	U	4.2	UJ	4.1	U	4.2	U	4.1	U	6.9	U
Vanadium			UG/L	257		1.2	U	3.8		1.6	U	1.2	U	1.6	U	1.6	U
Zinc	300	NYS CLASS GA STANDARD	UG/L	**3370**		32.4	R	91.2	R	42		4.5	R	5.1	U	6.3	U

Note: Shaded values exceed the NYS Class GA Standard or EPA MCL.

Table 4-17
SEAD-16 Summary of Analytes Detected in Groundwater

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

		LOC_ID:		MW16-6		MW16-6		MW16-7		MW16-7		MW16-7	
		SAMP ID:		16111		16155		16104		16158		16159	
		QC CODE:		SA		SA		SA		SA		DU	
		STUDY ID:		RI ROUND1		RI ROUND2		RI ROUND1		RI ROUND2		RI ROUND2	
		MATRIX:		WATER		WATER		WATER		WATER		WATER	
		SAMPLE DATE:		9/3/96		12/8/96		8/28/96		12/8/96		12/8/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
SEMIVOLATILE ORGANICS													
3-Nitroaniline			UG/L	25	U	25	U	25	J	25	U	25	U
4-Chloroaniline	5	NYS CLASS GA STANDARD	UG/L	10	U	10	U	10	J	10	U	10	U
Benzo[ghi]perylene			UG/L	10	U	10	U	10	U	10	U	10	U
Dibenz[a,h]anthracene			UG/L	10	U	10	U	10	U	10	U	10	U
Diethyl phthalate			UG/L	10	U	10	U	10	U	10	U	10	U
Indeno[1,2,3-cd]pyrene			UG/L	10	U	10	U	10	U	10	U	10	U
OTHER ANALYSES													
Nitrate/Nitrite Nitrogen			MG/L	0.01	U	0.01	U	0.83		0.24		0.23	
Percent Solids (Metals)				0		0		0		0		0	
Total Petroleum Hydrocarbons			MG/L	0.89		0.73		0.41	U	0.46	U	1.3	
NITROAROMATICS													
1,3-Dinitrobenzene	5	NYS CLASS GA STANDARD	UG/L	0.26	U	0.26	U	0.26		0.26	U	0.26	U
2,4-Dinitrotoluene	5	NYS CLASS GA STANDARD	UG/L	0.26	U	0.26	U	0.26	U	0.26	U	0.26	U
METALS													
Aluminum	200	EPA SECONDARY MCL	UG/L	**208**		170	U	12.4		67.4	U	52.9	U
Antimony	6	EPA MCL	UG/L	2	U	3	U	15.7	U	8.9	U	10	U
Arsenic	25	NYS CLASS GA STANDARD	UG/L	2.7	U	4.4	U	4	U	4.4	U	4.4	U
Barium	1000	NYS CLASS GA STANDARD	UG/L	86.4		80.2	U	89.2		59.1	U	60.2	U
Beryllium	4	EPA MCL	UG/L	0.1	U	0.2	U	0.21		0.2	U	0.2	U
Cadmium	5	EPA MCL	UG/L	0.3	U	0.6	U	0.3	U	0.6	U	0.6	U
Calcium			UG/L	44600		84900		109000		114000		117000	
Chromium	50	NYS CLASS GA STANDARD	UG/L	1.5		1	U	1		1	U	1	U
Cobalt			UG/L	1.2		1.3	U	1.2		1.3	U	1.3	U
Copper	200	NYS CLASS GA STANDARD	UG/L	4.4		1.1	U	5.1		1.4	U	2.1	U
Iron	300	NYS CLASS GA STANDARD	UG/L	273	J	290		23.4		174		160	
Lead	15	EPA MCL	UG/L	1.7	U	1.5	U	8.4		9.9		9.2	
Magnesium			UG/L	6370		12800		16900		22600		23200	
Manganese	50	EPA SECONDARY MCL	UG/L	**545**		**1380**		**85.7**		43.2		44.3	
Mercury	2	NYS CLASS GA STANDARD	UG/L	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Nickel	100	EPA MCL	UG/L	4.1		2.5	U	2.2		2.5	U	2.5	U
Potassium			UG/L	3530		2230	U	3220		2090	U	2160	U

Note: Shaded values exceed the NYS Class GA Standard or EPA MCL.

Table 4-17
SEAD-16 Summary of Analytes Detected in Groundwater

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

		LOC ID:		MW16-6		MW16-6		MW16-7		MW16-7		MW16-7	
		SAMP ID:		16111		16155		16104		16158		16159	
		QC CODE:		SA		SA		SA		SA		DU	
		STUDY ID:		RI ROUND1		RI ROUND2		RI ROUND1		RI ROUND2		RI ROUND2	
		MATRIX:		WATER		WATER		WATER		WATER		WATER	
		SAMPLE DATE:		9/3/96		12/8/96		8/28/96		12/8/96		12/8/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Selenium	10	NYS CLASS GA STANDARD	UG/L	2.4	U	4.7	UJ	2.4	U	4.7	UJ	4.7	UJ
Sodium	20000	NYS CLASS GA STANDARD	UG/L	**396000**		**409000**		12000		9940		10200	
Thallium	2	EPA MCL	UG/L	**6.2**		4.1	U	**4.2**		**11**		4.1	U
Vanadium			UG/L	2.9		1.6	U	1.2		1.6	U	1.6	U
Zinc	300	NYS CLASS GA STANDARD	UG/L	13.2	R	10.5	U	2.9	R	2.2	U	7.3	U

Note Shaded values exceed the NYS Class GA Standard or EPA MCL

Table 4-18

VOCs and TICs in Groundwater (ug/L)

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Montoring Well ID	Sample ID	Study ID	Total TCL VOCs	Total TICs	Total All VOCs
MW16-1	MW16-1-1	ESI	0	0.0	0.0
MW16-1	16101	Round I	0	0.0	0.0
MW16-2	MW16-2-1	ESI	0	0.0	0.0
MW16-2	MW16-41-1	ESI	0	0.0	0.0
MW16-2	16102	Round I	0	1.6	1.6
MW16-3	MW16-3-1	ESI	0	0.0	0.0
MW16-3	16110	Round I	0	0.0	0.0
MW16-3	16115 (2)	Round I	0	0.0	0.0
MW16-4	16105	Round I	0	0.9	0.9
MW16-5	Not Sampled (1)	Not Sampled	Not Sampled	Not Sampled	Not Sampled
MW16-6	16111	Round I	0	1.0	1.0
MW16-7	16104	Round I	0	0.0	0.0

(1) Not Sampled. There was an insufficient amount of standing water to sample.
(2) Sample 16115 is a duplicate sample of 16110.

Groundwater Sampling Round 2 - December 1996

No pesticides or PCBs were found in any of the groundwater samples collected from the seven monitoring wells sampled at SEAD-16.

4.1.5.4 Nitroaromatics

Groundwater Sampling Round 1 - August 1996

Two nitroaromatic compounds were detected in the groundwater samples collected from the six monitoring wells sampled at SEAD-16, however, none of the concentrations exceeded the NYS Class GA standards.

The NYS Class GA Standard for the compound 2,4-dinitrotoluene (5 µg/L) was exceeded by the detection limit for five samples.

Groundwater Sampling Round 2 - December 1996

No nitroaromatic compounds were detected in the groundwater samples collected from the seven monitoring wells at the site.

4.1.5.5. Herbicides

Herbicides were not analyzed as part of the RI groundwater sampling program. [However, no herbicides were found in well MW16-1 through MW16-3 based on results of samples analyzed as part of the ESI program.]

4.1.5.6 Metals

Groundwater Sampling Round 1 - August 1996

Metals were detected in all six monitoring wells sampled at SEAD-16 (Table 4-17). Summary statistics for all metals are shown in Table 4-16.

Seven metals were found at concentrations that exceeded their respective NYS Class GA or federal MCL standards. Aluminum was detected at concentrations above the EPA Secondary MCL in groundwater samples from four of the monitoring wells. Its maximum concentration of 1,850

µg/L was detected in groundwater from MW16-1. Antimony was detected in two monitoring wells at

concentrations above the EPA MCL. Antimony's maximum concentration of 12.3 µg/L was detected in groundwater from monitoring well MW16-3 which is located adjacent to the southwest side of Building S-311. Iron, with a maximum concentration of 2,400 J µg/L in MW16-1, exceeded the GA standard in three of the six wells sampled on-site. Lead was detected in only one well at a concentration above the EPA MCL. The concentration of lead in MW16-3 was 24.1 J µg/L. Manganese was detected at a maximum concentration of 545 µg/L in monitoring well MW16-6 and exceeded the EPA Secondary MCL in six of the wells. Sodium exceeded the GA standard in only one of the wells at SEAD-16, with a concentration of 396,000 µg/L being detected at MW16-6. Thallium was detected in groundwater from three monitoring wells at concentrations above the EPA MCL. Thallium's maximum concentration of 6.2 µg/L was detected in the sample from MW16-6 which is located at the northwest corner of Building S-311.

The metals antimony and thallium had detection limits above the respective EPA MCLs. For antimony, the EPA MCL value of 6 µg/L was exceeded in three samples from Round 1 of the RI. For thallium, the EPA MCL of 2 ug/L was exceeded in seven samples from Round 1 of the RI.

Groundwater Sampling Round 2 - December 1996

Metals were detected in all seven monitoring wells sampled at SEAD-16 (Table 4-17).

Four metals were found at concentrations that exceeded their respective NYS Class GA or federal MCL standards. Aluminum was detected at concentrations above the EPA Secondary MCL in the groundwater sample from one of the monitoring wells. A concentration of 490 µg/L was detected in groundwater from MW16-2. Iron, with a concentration of 923 J µg/L in MW16-2, exceeded the GA standard in only one of the seven wells sampled on-site. Manganese was detected at a maximum concentration of 1380 µg/L in monitoring well MW16-6 and exceeded the EPA Secondary MCL in six of the wells. Sodium exceeded the GA standard in only two of the wells at SEAD-16, with a concentration of 49,500 µg/L being detected at MW16-5 and 409,000 µg/L detected in MW16-6.

The metals antimony and thallium had detection limits above the respective EPA MCLs. For antimony, the EPA MCL of 6 µg/L was exceeded in two samples from Round 2 of the RI. For thallium, the EPA MCL of 2 ug/L was exceeded in eight samples from Round 2 of the RI.

4.1.5.6 Other Constituents

Nitrate/Nitrite-Nitrogen

Nitrate/nitrite-nitrogen was detected in the groundwater samples ranging from 0.02 mg/L to 0.83 mg/L in Round 1 samples and from 0.23 mg/L to 2 mg/L in Round 2 samples.

Total Petroleum Hydrocarbons

Groundwater Sampling Round 1 - August 1996

Total petroleum hydrocarbons were detected in two of the six groundwater monitoring wells sampled at SEAD-16. The detected concentrations ranged between 0.89 mg/L at MW16-6 and 1.3 mg/L at MW16-3. There is no State or federal criteria for total petroleum hydrocarbons.

Groundwater Sampling Round 2 - December 1996

Total petroleum hydrocarbons were detected in four of the seven groundwater monitoring wells sampled at SEAD-16 in Round 2. The detected concentrations ranged between 0.73 mg/L at MW16-6 and 1.3 mg/L at MW16-7.

4.1.6 Surface Water

The surface water at SEAD-16 has not been classified by NYSDEC. However, because the drainage ditches near SEAD-16 form the headwaters for Kendaia Creek, the lower portion of which is designated as Class C surface water by NYSDEC, the Class C standards were used to provide a basis of comparison for the on-site surface water chemical data. The Class C standards are not strictly applicable to the surface water found at SEAD-16.

Standing water samples SW16-1 and SW16-2 were collected during the ESI from within the rooms of the Abandoned Deactivation Furnace. These samples were discussed in Section 4.1.2, Building Materials.

Summary statistics for the surface water analyses are shown in Table 4-20.

4.1.6.1 Volatile Organic Compounds

No VOCs were detected at the 11 surface water sample locations at the site (Table 4-21).

TICs were identified in three of the surface water samples (Table 4-22). The highest concentration of TICs (8 µg/L) was found at SW/SD16-5.

4.1.6.2 Semivolatile Organic Compounds

Three SVOCs were detected at 3 of the 11 surface water sampling locations on the site (Table 4-21). One of the SVOCs exceeded the New York State Class C surface water standards. Bis(2-ethylhexyl)phthalate was detected at locations SW/SD16-5 and SW/SD16-10 at a maximum concentration of 3 J µg/L, which is above the NYS Class C criteria of 0.6 µg/L.

The TAGM values for pentachlorophenol and bis(2-ethylhexyl)phthalate were exceeded by the detection limits in most samples.

TICs were identified in three of the surface water samples, and the concentrations were relatively low. The highest concentration (65 µg/L) was found at SW/SD16-9 (Table 4-23).

4.1.6.3 Pesticide and PCBs

No pesticides or PCBs were found in any of the surface water samples collected at SEAD-16.

4.1.6.4 Nitroaromatics

No nitroaromatic compounds were detected in the surface water samples collected at SEAD-16.

4.1.6.5 Herbicides

Herbicides were not part of the laboratory analytical suite for the surface water at SEAD-16.

4.1.6.6 Metals

NYS Class C surface water quality standards were used as a basis of comparison for the surface water samples. The Class C surface water quality standard values for chromium, copper, lead, nickel, and zinc are based on the hardness of the surface water at the site. Hardness is expressed as the total concentration of Ca^{2+} and Mg^{2+} as mg/L equivalent of $CaCO_3$ (Freeze and Cherry, 1979). Hardness (*H*) can be determined by substituting the concentrations of Ca^{2+} and Mg^{2+}, expressed in mg/L, in the expression shown below:

Table 4-20
SEAD-16 Summary Statistics of Surface Water Samples

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
VOLATILE ORGANICS								
1,1,1-Trichloroethane	UG/L	13	0	0%				
1,1,2,2-Tetrachloroethane	UG/L	13	0	0%				
1,1,2-Trichloroethane	UG/L	13	0	0%				
1,1-Dichloroethane	UG/L	13	0	0%				
1,1-Dichloroethene	UG/L	13	0	0%				
1,2-Dichloroethane	UG/L	13	0	0%				
1,2-Dichloroethene (total)	UG/L	13	0	0%				
1,2-Dichloropropane	UG/L	13	0	0%				
2-Butanone	UG/L	13	0	0%				
2-Hexanone	UG/L	13	0	0%				
4-Methyl-2-Pentanone	UG/L	13	0	0%				
Acetone	UG/L	13	0	0%				
Benzene	UG/L	13	0	0%				
Bromodichloromethane	UG/L	13	0	0%				
Bromoform	UG/L	13	0	0%				
Bromomethane	UG/L	13	0	0%				
Carbon Disulfide	UG/L	13	0	0%				
Carbon Tetrachloride	UG/L	13	0	0%				
Chlorobenzene	UG/L	13	0	0%				
Chloroethane	UG/L	13	0	0%				
Chloroform	UG/L	13	0	0%				
Chloromethane	UG/L	13	0	0%				
Dibromochloromethane	UG/L	13	0	0%				
Ethylbenzene	UG/L	13	0	0%				
Methylene Chloride	UG/L	13	0	0%				
Styrene	UG/L	13	0	0%				
Tetrachloroethene	UG/L	13	0	0%				
Toluene	UG/L	13	0	0%				
Trichloroethene	UG/L	13	0	0%				
Vinyl Chloride	UG/L	13	0	0%				
Xylene (total)	UG/L	13	0	0%				
cis-1,3-Dichloropropene	UG/L	13	0	0%				
trans-1,3-Dichloropropene	UG/L	13	0	0%				
SEMIVOLATILE ORGANICS								
1,2,4-Trichlorobenzene	UG/L	13	0	0%				
1,2-Dichlorobenzene	UG/L	13	0	0%				
1,3-Dichlorobenzene	UG/L	13	0	0%				
1,4-Dichlorobenzene	UG/L	13	0	0%				
2,2'-oxybis(1-Chloropropane)	UG/L	2	0	0%				

Table 4-20
SEAD-16 Summary Statistics of Surface Water Samples

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
2,4,5-Trichlorophenol	UG/L	13	0	0%				
2,4,6-Trichlorophenol	UG/L	13	0	0%				
2,4-Dichlorophenol	UG/L	13	0	0%				
2,4-Dimethylphenol	UG/L	13	0	0%				
2,4-Dinitrophenol	UG/L	13	0	0%				
2,4-Dinitrotoluene	UG/L	13	0	0%				
2,6-Dinitrotoluene	UG/L	13	0	0%				
2-Chloronaphthalene	UG/L	13	0	0%				
2-Chlorophenol	UG/L	13	0	0%				
2-Methylnaphthalene	UG/L	13	0	0%				
2-Methylphenol	UG/L	13	0	0%				
2-Nitroaniline	UG/L	13	0	0%				
2-Nitrophenol	UG/L	13	0	0%				
3,3'-Dichlorobenzidine	UG/L	13	0	0%				
3-Nitroaniline	UG/L	13	0	0%				
4,6-Dinitro-2-methylphenol	UG/L	13	0	0%				
4-Bromophenyl-phenylether	UG/L	13	0	0%				
4-Chloro-3-methylphenol	UG/L	13	0	0%				
4-Chloroaniline	UG/L	13	0	0%				
4-Chlorophenyl-phenylether	UG/L	13	0	0%				
4-Methylphenol	UG/L	13	0	0%				
4-Nitroaniline	UG/L	13	0	0%				
4-Nitrophenol	UG/L	13	0	0%				
Acenaphthene	UG/L	13	0	0%				
Acenaphthylene	UG/L	13	0	0%				
Anthracene	UG/L	13	0	0%				
Benzo(a)anthracene	UG/L	13	0	0%				
Benzo(a)pyrene	UG/L	13	0	0%				
Benzo(b)fluoranthene	UG/L	13	0	0%				
Benzo(g,h,i)perylene	UG/L	13	0	0%				
Benzo(k)fluoranthene	UG/L	13	0	0%				
Butylbenzylphthalate	UG/L	13	0	0%				
Carbazole	UG/L	13	0	0%				
Chrysene	UG/L	13	0	0%				
Di-n-butylphthalate	UG/L	13	1	8%	0.5	0.5	0.5	0
Di-n-octylphthalate	UG/L	13	0	0%				
Dibenz(a,h)anthracene	UG/L	13	0	0%				
Dibenzofuran	UG/L	13	0	0%				
Diethylphthalate	UG/L	13	0	0%				
Dimethylphthalate	UG/L	13	0	0%				

Table 4-20
SEAD-16 Summary Statistics of Surface Water Samples

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
Fluoranthene	UG/L	13	0	0%				
Fluorene	UG/L	13	0	0%				
Hexachlorobenzene	UG/L	13	0	0%				
Hexachlorobutadiene	UG/L	13	0	0%				
Hexachlorocyclopentadiene	UG/L	13	0	0%				
Hexachloroethane	UG/L	13	0	0%				
Indeno(1,2,3-cd)pyrene	UG/L	13	0	0%				
Isophorone	UG/L	13	0	0%				
N-Nitroso-di-n-propylamine	UG/L	13	0	0%				
N-Nitrosodiphenylamine (1)	UG/L	13	0	0%				
Naphthalene	UG/L	13	0	0%				
Nitrobenzene	UG/L	13	0	0%				
Pentachlorophenol	UG/L	13	3	23%	0.7	4	1.9	1.825
Phenanthrene	UG/L	13	0	0%				
Phenol	UG/L	13	0	0%				
Pyrene	UG/L	13	0	0%				
bis(2-Chloroethoxy) methane	UG/L	13	0	0%				
bis(2-Chloroethyl) ether	UG/L	13	0	0%				
bis(2-Chloroisopropyl) ether	UG/L	11	0	0%				
bis(2-Ethylhexyl)phthalate	UG/L	13	3	23%	1	3	2.333	1.155
PESTICIDES/PCB								
4,4'-DDD	UG/L	13	0	0%				
4,4'-DDE	UG/L	13	0	0%				
4,4'-DDT	UG/L	13	0	0%				
Aldrin	UG/L	13	0	0%				
Aroclor-1016	UG/L	13	0	0%				
Aroclor-1221	UG/L	13	0	0%				
Aroclor-1232	UG/L	13	0	0%				
Aroclor-1242	UG/L	13	0	0%				
Aroclor-1248	UG/L	13	0	0%				
Aroclor-1254	UG/L	13	0	0%				
Aroclor-1260	UG/L	13	0	0%				
Dieldrin	UG/L	13	0	0%				
Endosulfan I	UG/L	13	0	0%				
Endosulfan II	UG/L	13	0	0%				
Endosulfan sulfate	UG/L	13	0	0%				
Endrin	UG/L	13	0	0%				
Endrin aldehyde	UG/L	13	0	0%				
Endrin ketone	UG/L	13	0	0%				
Heptachlor	UG/L	13	0	0%				

Table 4-19

SVOCs and TICs in Groundwater (ug/L)

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Montoring Well ID	Sample ID	Study ID	Total TCL SVOCs	Total TICs	Total All SVOCs
MW16-1	MW16-1-1	ESI	0.0	13	13.0
MW16-1	16101	Round I	0.0	188	188.0
MW16-2	MW16-2-1	ESI	0.0	6	6.0
MW16-2	MW16-41-1	ESI	0.0	11	11.0
MW16-2	16102	Round I	0.0	2	2.0
MW16-3	MW16-3-1	ESI	0.5	12	12.5
MW16-3	16110	Round I	2.3	0	2.3
MW16-3	16115	Round I	0.0	10	10.0
MW16-4	16105	Round I	0.0	0	0.0
MW16-5	Not Sampled (1)	Not Sampled	Not Sampled	Not Sampled	Not Sampled
MW16-6	16111	Round I	0.0	28	28.0
MW16-7	16104	Round I	35.0	0	35.0

(1) Not Sampled. There was an insufficient amount of standing water to sample.

Table 4-20
SEAD-16 Summary Statistics of Surface Water Samples

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
Heptachlor epoxide	UG/L	13	0	0%				
Methoxychlor	UG/L	13	0	0%				
Toxaphene	UG/L	13	0	0%				
alpha-BHC	UG/L	13	0	0%				
alpha-Chlordane	UG/L	13	0	0%				
beta-BHC	UG/L	13	0	0%				
delta-BHC	UG/L	13	0	0%				
gamma-BHC (Lindane)	UG/L	13	0	0%				
gamma-Chlordane	UG/L	13	0	0%				
OTHER ANALYSES								
Nitrate/Nitrite-Nitrogen	MG/L	13	11	85%	0.02	1.77	0.473	0.551
Percent Solids (Metals)		11	11	100%	0	0	0	0
Total Organic Carbon	MG/L	11	11	100%	2.3	12.5	5.591	3.579
pH	MG/L	11	11	100%	7.34	7.8	7.544	0.15
NITROAROMATICS								
1,3,5-Trinitrobenzene	UG/L	24	0	0%				
1,3-Dinitrobenzene	UG/L	24	0	0%				
2,4,6-Trinitrotoluene	UG/L	24	0	0%				
2,4-Dinitrotoluene	UG/L	24	0	0%				
2,6-Dinitrotoluene	UG/L	24	0	0%				
2-Nitrotoluene	UG/L	11	0	0%				
2-amino-4,6-Dinitrotoluene	UG/L	24	0	0%				
3-Nitrotoluene	UG/L	11	0	0%				
4-Nitrotoluene	UG/L	11	0	0%				
4-amino-2,6-Dinitrotoluene	UG/L	24	0	0%				
HMX	UG/L	24	0	0%				
Nitrobenzene	UG/L	22	0	0%				
RDX	UG/L	24	0	0%				
Tetryl	UG/L	24	0	0%				
METALS								
Aluminum	UG/L	13	2	15%	152	261	206.5	77.075
Antimony	UG/L	13	11	85%	3.6	124	30.418	38.325
Arsenic	UG/L	13	8	62%	3	5.7	3.963	0.89
Barium	UG/L	13	13	100%	60.6	348	118.015	74.088
Beryllium	UG/L	13	0	0%				
Cadmium	UG/L	13	7	54%	0.43	2	0.79	0.544
Calcium	UG/L	13	13	100%	45900	89900	72223.08	15020.38
Chromium	UG/L	13	3	23%	2.1	3	2.433	0.493
Cobalt	UG/L	13	2	15%	2.6	4.1	3.35	1.061
Copper	UG/L	13	13	100%	13.5	424	58.808	110.744

Table 4-20
SEAD-16 Summary Statistics of Surface Water Samples

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
Cyanide	UG/L	13	0	0%				
Iron	UG/L	13	11	85%	32.4	3650	964.4	1346.516
Lead	UG/L	13	13	100%	5.4	813	111.985	215.616
Magnesium	UG/L	13	13	100%	4300	11400	9125.385	2289.453
Manganese	UG/L	13	13	100%	2.4	252	52.362	72.622
Mercury	UG/L	13	3	23%	0.1	0.9	0.397	0.438
Nickel	UG/L	13	8	62%	2.7	5.5	4.163	0.941
Potassium	UG/L	13	13	100%	1200	4590	2980.769	986.758
Selenium	UG/L	13	4	31%	1.1	4.3	2.725	1.307
Silver	UG/L	13	1	8%	5.2	5.2	5.2	0
Sodium	UG/L	13	13	100%	1150	9220	5642.308	2669.926
Thallium	UG/L	13	0	0%				
Vanadium	UG/L	13	7	54%	1.3	4.9	2.986	1.574
Zinc	UG/L	13	13	100%	28.5	380	126.415	103.784
HERBICIDES								
2,4,5-T	UG/L	2	0	0%				
2,4,5-TP (Silvex)	UG/L	2	0	0%				
2,4-D	UG/L	2	0	0%				
2,4-DB	UG/L	2	0	0%				
Dalapon	UG/L	2	0	0%				
Dicamba	UG/L	2	0	0%				
Dichloroprop	UG/L	2	0	0%				
Dinoseb	UG/L	2	0	0%				
MCPA	UG/L	2	0	0%				
MCPP	UG/L	2	0	0%				

Table 4-21
SEAD-16 Summary of Analytes Detected in Surface Water

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SW/SD16-1		SW/SD16-10		SW/SD16-2		SW/SD16-3	
			SAMP ID:	16143		16129		16135		16133	
			QC CODE:	SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:								
			BOTTOM:								
			MATRIX:	SURFACE WATER		SURFACE WATER		SURFACE WATER		SURFACE WATER	
			SAMPLE DATE:	9/18/96		9/18/96		9/18/96		9/18/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
SEMIVOLATILE ORGANICS											
Di-n-butylphthalate			UG/L	10	U	10	U	10	U	10	U
Pentachlorophenol	0.4	NYS AWQS CLASS C	UG/L	25	U	0.7	J	25	U	25	U
bis(2-Ethylhexyl)phthalate	0.6	NYS AWQS CLASS C	UG/L	10	U	3	J	10	U	10	U
OTHER ANALYSES											
Nitrate/Nitrite-Nitrogen			MG/L	0.34		0.01	U	0.49		0.43	
Percent Solids (Metals)				0		0		0		0	
Total Organic Carbon			MG/L	5		6.4		3.2		2.3	
pH			MG/L	7.39		7.62		7.34		7.57	
METALS											
Aluminum	100	NYS AWQS CLASS C	UG/L	26.8	R	118	R	34.2	R	401	R
Antimony			UG/L	10.4	J	5.3	J	14.7	J	124	J
Arsenic	190	NYS AWQS CLASS C	UG/L	3	J	2.7	U	2.7	U	5.7	J
Barium			UG/L	75.3	J	103	J	114	J	100	J
Cadmium	1.86	NYS AWQS CLASS C	UG/L	0.3	U	0.71	J	0.3	U	2	J
Calcium			UG/L	79000		73300		87900		69800	
Chromium	347.27	NYS AWQS CLASS C	UG/L	1	U	1	U	1	U	2.1	J
Cobalt	5	NYS AWQS CLASS C	UG/L	1.2	U	1.2	U	1.2	U	1.2	U
Copper	20.29	NYS AWQS CLASS C	UG/L	13.5		17.9		13.9		424	

Note: Shaded values exceed the NYS AWQS Class C.

Table 4-21
SEAD-16 Summary of Analytes Detected in Surface Water

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SW/SD16-1		SW/SD16-10		SW/SD16-2		SW/SD16-3	
			SAMP ID:	16143		16129		16135		16133	
			QC CODE:	SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:								
			BOTTOM:								
			MATRIX:	SURFACE WATER		SURFACE WATER		SURFACE WATER		SURFACE WATER	
			SAMPLE DATE:	9/18/96		9/18/96		9/18/96		9/18/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Iron	300	NYS AWQS CLASS C	UG/L	32.4	J	210	J	41	J	1550	J
Lead	7.16	NYS AWQS CLASS C	UG/L	5.4		11.7		34.3		813	
Magnesium			UG/L	8080		6800		11400		11200	
Manganese			UG/L	18.4		47.3		8.6		22.6	
Mercury			UG/L	0.1	U	0.1	U	0.1	U	0.9	
Nickel	154.49	NYS AWQS CLASS C	UG/L	1.6	U	4.8		1.6	U	3.5	
Potassium			UG/L	2380		2460		1200		4590	
Selenium	1	NYS AWQS CLASS C	UG/L	2.4	U	2.4	U	2.8	J	2.4	U
Silver	0.1	NYS AWQS CLASS C	UG/L	1.3	U	1.3	U	1.3	U	1.3	U
Sodium			UG/L	4720		4830		5540		8280	
Vanadium	14	NYS AWQS CLASS C	UG/L	1.2	U	1.2	U	1.2	U	1.3	J
Zinc	141.38	NYS AWQS CLASS C	UG/L	28.5		158		71.7		253	

Note: Shaded values exceed the NYS AWQS Class C.

Table 4-21
SEAD-16 Summary of Analytes Detected in Surface Water

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SW/SD16-4		SW/SD16-4		SW/SD16-5		SW/SD16-6	
			SAMP ID:	16119		16125		16142		16126	
			QC CODE:	SA		DU		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:								
			BOTTOM:								
			MATRIX:	SURFACE WATER		SURFACE WATER		SURFACE WATER		SURFACE WATER	
			SAMPLE DATE:	9/18/96		9/18/96		9/18/96		9/18/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
SEMIVOLATILE ORGANICS											
Di-n-butylphthalate			UG/L	10	U	10	U	0.5	J	10	U
Pentachlorophenol	0.4	NYS AWQS CLASS C	UG/L	25	U	25	U	25	U	25	U
bis(2-Ethylhexyl)phthalate	0.6	NYS AWQS CLASS C	UG/L	10	U	10	U	3	J	10	U
OTHER ANALYSES											
Nitrate/Nitrite-Nitrogen			MG/L	0.26		0.31		0.15		0.02	
Percent Solids (Metals)				0		0		0		0	
Total Organic Carbon			MG/L	2.8		2.8		4		12.5	
pH			MG/L	7.46		7.59		7.36		7.75	
METALS											
Aluminum	100	NYS AWQS CLASS C	UG/L	123	R	69.6	R	976	R	43.2	R
Antimony			UG/L	59.1	J	68.8	J	3.6	J	27.3	J
Arsenic	190	NYS AWQS CLASS C	UG/L	4	J	2.7	U	3.6	J	3	J
Barium			UG/L	155	J	116	J	64.4	J	348	J
Cadmium	1.86	NYS AWQS CLASS C	UG/L	0.43	J	0.3	U	0.63	J	0.54	J
Calcium			UG/L	78600		75300		89900		79600	
Chromium	347.27	NYS AWQS CLASS C	UG/L	1	U	1	U	2.2	J	1	U
Cobalt	5	NYS AWQS CLASS C	UG/L	1.2	U	1.2	U	2.6		1.2	U
Copper	20.29	NYS AWQS CLASS C	UG/L	33.4		26.7		25.7		40.9	

Note: Shaded values exceed the NYS AWQS Class C.

Table 4-21
SEAD-16 Summary of Analytes Detected in Surface Water

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SW/SD16-4		SW/SD16-4		SW/SD16-5		SW/SD16-6	
			SAMP ID:	16119		16125		16142		16126	
			QC CODE:	SA		DU		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:								
			BOTTOM:								
			MATRIX:	SURFACE WATER		SURFACE WATER		SURFACE WATER		SURFACE WATER	
			SAMPLE DATE:	9/18/96		9/18/96		9/18/96		9/18/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Iron	300	NYS AWQS CLASS C	UG/L	1140	J	272	J	3340	J	58.3	J
Lead	7.16	NYS AWQS CLASS C	UG/L	96.8		34.2		66.8		36.6	
Magnesium			UG/L	11400		11100		10100		10500	
Manganese			UG/L	53		42.8		161		11.6	
Mercury			UG/L	0.1	U	0.1	U	0.1	U	0.1	U
Nickel	154.49	NYS AWQS CLASS C	UG/L	2.7		3.7		3.8		1.6	U
Potassium			UG/L	3890		3790		2510		4510	
Selenium	1	NYS AWQS CLASS C	UG/L	2.4	U	2.4	U	4.3	J	2.4	U
Silver	0.1	NYS AWQS CLASS C	UG/L	1.3	U	1.3	U	1.3	U	1.3	U
Sodium			UG/L	7730		7620		5670		1320	
Vanadium	14	NYS AWQS CLASS C	UG/L	1.5	J	1.2	U	3.7	J	1.2	U
Zinc	141.38	NYS AWQS CLASS C	UG/L	217		125		104		55	

Note: Shaded values exceed the NYS AWQS Class C.

Table 4-21
SEAD-16 Summary of Analytes Detected in Surface Water

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SW/SD16-7		SW/SD16-8		SW/SD16-9		SW16-1	
			SAMP ID:	16127		16134		16128		SW16-1-1	
			QC CODE:	SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		ESI	
			TOP:							0	
			BOTTOM:							0.2	
			MATRIX:	SURFACE WATER		SURFACE WATER		SURFACE WATER		SURFACE WATER	
			SAMPLE DATE:	9/18/96		9/18/96		9/18/96		12/6/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
SEMIVOLATILE ORGANICS											
Di-n-butylphthalate			UG/L	10	U	10	U	10	U	11	U
Pentachlorophenol	0.4	NYS AWQS CLASS C	UG/L	1	J	25	U	4	J	27	U
bis(2-Ethylhexyl)phthalate	0.6	NYS AWQS CLASS C	UG/L	10	U	10	U	1	J	11	U
OTHER ANALYSES											
Nitrate/Nitrite-Nitrogen			MG/L	0.12		0.01	U	0.04		1.27	
Percent Solids (Metals)				0		0		0			
Total Organic Carbon			MG/L	2.8		10.4		9.3			
pH			MG/L	7.57		7.53		7.8			
METALS											
Aluminum	100	NYS AWQS CLASS C	UG/L	1540	R	77.1	R	190	R	152	J
Antimony			UG/L	6.5	J	7.2	J	7.7	J	21.5	U
Arsenic	190	NYS AWQS CLASS C	UG/L	4.5	J	4.3	J	3.6	J	0.8	U
Barium			UG/L	74.4	J	117	J	122	J	60.6	J
Cadmium	1.86	NYS AWQS CLASS C	UG/L	0.72	J	0.3	U	0.5	J	2.1	U
Calcium			UG/L	88400		46100		45900		71700	
Chromium	347.27	NYS AWQS CLASS C	UG/L	3	J	1	U	1	U	2.6	U
Cobalt	5	NYS AWQS CLASS C	UG/L	4.1		1.2	U	1.2	U	4.4	U
Copper	20.29	NYS AWQS CLASS C	UG/L	24.9		15.6		41.1		19.3	J

Note: Shaded values exceed the NYS AWQS Class C.

Table 4-21
SEAD-16 Summary of Analytes Detected in Surface Water

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SW/SD16-7		SW/SD16-8		SW/SD16-9		SW16-1	
			SAMP ID:	16127		16134		16128		SW16-1-1	
			QC CODE:	SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		ESI	
			TOP:							0	
			BOTTOM:							0.2	
			MATRIX:	SURFACE WATER		SURFACE WATER		SURFACE WATER		SURFACE WATER	
			SAMPLE DATE:	9/18/96		9/18/96		9/18/96		12/6/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Iron	300	NYS AWQS CLASS C	UG/L	**3650**	**J**	94.7	J	220	J	281	R
Lead	7.16	NYS AWQS CLASS C	UG/L	**67.4**		6.5		**37.3**		**67.8**	
Magnesium			UG/L	10000		5990		4300		9590	
Manganese			UG/L	252		2.4		18.4		8.7	J
Mercury			UG/L	0.1	U	0.1	U	0.1	U	0.1	J
Nickel	154.49	NYS AWQS CLASS C	UG/L	5.5		1.6	U	4.1		4	U
Potassium			UG/L	2500		3150		2090		2560	J
Selenium	1	NYS AWQS CLASS C	UG/L	2.4	U	2.4	U	**2.7**	**J**	**1.1**	**J**
Silver	0.1	NYS AWQS CLASS C	UG/L	1.3	U	1.3	U	1.3	U	4.2	U
Sodium			UG/L	5380		1150		3040		9220	
Vanadium	14	NYS AWQS CLASS C	UG/L	4.9	J	1.2	U	1.3	J	3.7	J
Zinc	141.38	NYS AWQS CLASS C	UG/L	121		28.8		66.7		34.7	

Note: Shaded values exceed the NYS AWQS Class C.

Table 4-21
SEAD-16 Summary of Analytes Detected in Surface Water

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SW16-2	
			SAMP ID:	SW16-2-1	
			QC CODE:	SA	
			STUDY ID:	ESI	
			TOP:	0	
			BOTTOM:	0.2	
			MATRIX:	SURFACE WATER	
			SAMPLE DATE:	12/6/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q
SEMIVOLATILE ORGANICS					
Di-n-butylphthalate			UG/L	10	U
Pentachlorophenol	0.4	NYS AWQS CLASS C	UG/L	26	U
bis(2-Ethylhexyl)phthalate	0.6	NYS AWQS CLASS C	UG/L	10	U
OTHER ANALYSES					
Nitrate/Nitrite-Nitrogen			MG/L	1.77	
Percent Solids (Metals)					
Total Organic Carbon			MG/L		
pH			MG/L		
METALS					
Aluminum	100	NYS AWQS CLASS C	UG/L	261	
Antimony			UG/L	21.4	U
Arsenic	190	NYS AWQS CLASS C	UG/L	0.8	U
Barium			UG/L	84.5	J
Cadmium	1.86	NYS AWQS CLASS C	UG/L	2.1	U
Calcium			UG/L	53400	
Chromium	347.27	NYS AWQS CLASS C	UG/L	2.6	U
Cobalt	5	NYS AWQS CLASS C	UG/L	4.4	U
Copper	20.29	NYS AWQS CLASS C	UG/L	67.6	

Note: Shaded values exceed the NYS AWQS Class C.

Table 4-21
SEAD-16 Summary of Analytes Detected in Surface Water

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SW16-2	
			SAMP ID:	SW16-2-1	
			QC CODE:	SA	
			STUDY ID:	ESI	
			TOP:	0	
			BOTTOM:	0.2	
			MATRIX:	SURFACE WATER	
			SAMPLE DATE:	12/6/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q
Iron	300	NYS AWQS CLASS C	UG/L	551	R
Lead	7.16	NYS AWQS CLASS C	UG/L	178	
Magnesium			UG/L	8170	
Manganese			UG/L	33.9	
Mercury			UG/L	0.19	J
Nickel	154.49	NYS AWQS CLASS C	UG/L	5.2	J
Potassium			UG/L	3120	J
Selenium	1	NYS AWQS CLASS C	UG/L	0.7	U
Silver	0.1	NYS AWQS CLASS C	UG/L	5.2	J
Sodium			UG/L	8850	
Vanadium	14	NYS AWQS CLASS C	UG/L	4.5	J
Zinc	141.38	NYS AWQS CLASS C	UG/L	380	

Note: Shaded values exceed the NYS AWQS Class C.

Table 4-22

VOCs and TICs in Surface Water (ug/L)

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Surface Water Sampling Location	Surface Water Sample ID	Study ID	Total TCL VOCs	Total TICs	Total All VOCs
SW/SD16-1	16143	Round I	0	0	0
SW/SD16-2	16135	Round I	0	0	0
SW/SD16-3	16133	Round I	0	0	0
SW/SD16-4	16119	Round I	0	0	0
SW/SD16-4	16125 (1)	Round I	0	0	0
SW/SD16-5	16142	Round I	0	8	8
SW/SD16-6	16126	Round I	0	0	0
SW/SD16-7	16127	Round I	0	5	5
SW/SD16-8	16134	Round I	0	0	0
SW/SD16-9	16128	Round I	0	6	6
SW/SD16-10	16129	Round I	0	0	0
SW16-1	SW16-1-1	ESI	0	0	0
SW16-2	SW16-2-1	ESI	0	0	0

(1) Surface water sample 16125 is a duplicate of surface water sample 16119.

Table 4-23

SVOCs and TICs in Surface Water (ug/L)

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Surface Water Sampling Location	Surface Water Sample ID	Study ID	Total TCL SVOCs	Total TICs	Total All SVOCs
SW/SD16-1	16143	Round I	0.0	8	8.0
SW/SD16-2	16135	Round I	0.0	6	6.0
SW/SD16-3	16133	Round I	0.0	10	10.0
SW/SD16-4	16119	Round I	0.0	11	11.0
SW/SD16-4	16125 (1)	Round I	0.0	5	5.0
SW/SD16-5	16142	Round I	3.5	38	41.5
SW/SD16-6	16126	Round I	0.0	25	25.0
SW/SD16-7	16127	Round I	1.0	37	38.0
SW/SD16-8	16134	Round I	0.0	10	10.0
SW/SD16-9	16128	Round I	5.0	65	70.0
SW/SD16-10	16129	Round I	3.7	33	36.7
SW16-1	SW161	ESI	0.0	0	0.0
SW16-2	SW162	ESI	0.0	2	2.0

(1) Sample 16125 is a duplicate of sample 16119 at location SW/SD16-4.

$$H = 2.5\left(Ca^{2+}\right) + 4.1\left(Mg^{2+}\right.$$

Using this equation, and the average calcium and magnesium concentrations of 64.4 mg/L and 6.6 mg/L, respectively, from the background surface water sample locations SW/SD16-10, SW/SD17-1, and SW/SD17-4, a hardness value of 188.18 mg/L was calculated for SEAD-16. This hardness value was used in the calculation of the NYS Class C standards for the metals mentioned above. These three surface water locations were selected as the most appropriate "background" locations for both SEAD-16 and SEAD-17 because these sites were less likely to have been impacted by contaminants from the sites.

Metals were detected at all ten surface water sampling locations at the site (Table 4-21). Six metals (cadmium, copper, iron, lead, selenium, and zinc) were found at concentrations that exceeded their respective NYS Class C surface water standards. Cadmium was detected in only one sample (SW/SD16-3) at a concentration of 2 J µg/L, which is above the Class C standard of 1.8 µg/L. Copper exceeded the Class C standard in seven surface water samples and its maximum concentration of 424 µg/L was detected in SW/SD16-3. Iron, which exceeded the standard at four sample locations, was found at maximum concentration of 3,650 J µg/L at SW16-7. Lead exceeded the standard in nine samples. Lead's highest concentrations of 813 µg/L and 96.8 µg/L were detected in SW/SD16-3 and SW/SD16-4, respectively. These two samples were collected from the drainage ditch on the southeastern portion of the site. Selenium was detected in two samples at concentrations above the standard. A maximum concentration for selenium of 4.3 µg/L was detected in SW/SD16-5. Zinc was detected in three samples above the standard and the highest concentrations of 253 µg/L and 217 µg/L were detected in SW/SD16-3 and SW/SD16-4, respectively. Several of the maximum concentrations of the metals were detected in the surface water sample SW/SD16-3, which is located in the drainage ditch at the southeastern portion of the site. Figure 4-6 shows the distribution of copper, lead, and zinc in the surface water sample locations.

NYS Class C Standards values for selenium and silver were exceeded by the detection limits. For selenium, the NYS Class C Standard of 1 µg/L was slightly exceeded by the detection limit of 2.4 µg/L. For silver, the NYS Class C Standard of 0.1 µg/L was exceeded by the detection limit of 1.3 µg/L.

4.1.6.6 Other Constituents

Nitrate/Nitrite-Nitrogen

Nitrate/nitrite-nitrogen was detected at concentrations ranging from 0.02 mg/L to 0.49 mg/L (Table 4-21).

4.1.7 Sediment

For the purposes of the discussion of criteria exceedences below, sediment results were compared to the lowest of several available New York State guidelines for sediment. These standards included: the New York State lowest effect level (NYS LEL), New York State human health bioaccumulation criteria (NYS HHB), New York State benthic aquatic life acute toxicity criteria (NYS BALAT), New York State benthic aquatic life chronic toxicity criteria (NYS BALCT), and New York State wildlife bioaccumulation criteria (NYS WB). The criteria were developed based on an average organic carbon level of 3.65% in the sediment.

Summary statistics for the sediment analyses are shown in Table 4-24.

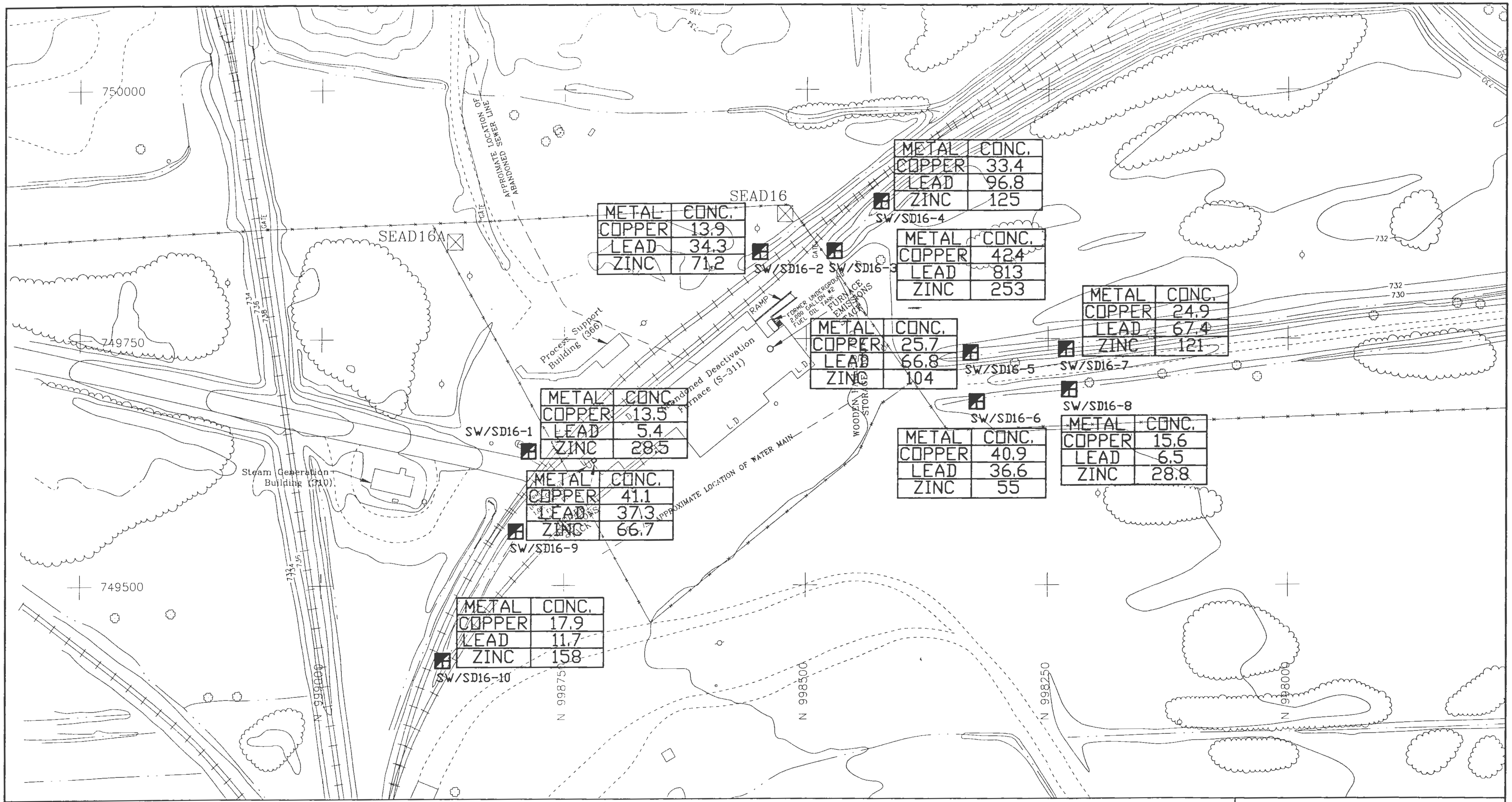
4.1.7.1 Volatile Organic Compounds

No VOCs, other than those considered to represent laboratory artifacts, were detected in the 11 sediment samples collected at the site (Table 4-25). Because 2-butanone and acetone appear in laboratory blanks, they are likely laboratory contaminants. These compounds were detected at low concentrations (between 12 µg/kg and 36 µg/kg) and are not believed to be representative of the true sediment chemistry at SEAD-16.

Samples collected from four locations contained VOC TICs (Table 4-26). Samples from SW/SD16-1, SW/SD16-4, SW/SD16-6, and SW/SD16-7, contained TIC concentrations of 360 µg/kg, 24 µg/kg, 31 µg/kg, and 308 µg/kg, respectively.

4.1.7.2 Semivolatile Organic Compounds

SVOCs, mainly PAHs, were detected at all but one of the sediment sample locations at SEAD-16. The applicable New York State standards for sediment were exceeded for six of the compounds (Table 4-25).



ACAD\SENECA\16-17RIF\SD16METL.DWG

LEGEND

MINOR WATERWAY
MAJOR WATERWAY
FENCE
UNPAVED ROAD
BRUSH LINE
LANDFILL EXTENTS
RAILROAD
760 GROUND SURFACE ELEVATION CONTOUR

☒ SURVEY MONUMENT
L.D. LOADING DOCK
ROAD SIGN
DECIDOUS TREE
FIRE HYDRANT
MANHOLE
GUIDE POST
POLE
UTILITY BOX
COORDINATE GRID (250' GRID)
OVERHEAD UTILITY POLE
MAILBOX/RR SIGNAL

SURFACE WATER LOCATION

SW/SD16-2

METAL	CONC.
COPPER	17.9
LEAD	11.7
ZINC	158

CONCETRATION IN ug/L

50 0 50 100
1' = 100'

N

PARSONS

PARSONS ENGINEERING SCIENCE, INC.

CLIENT/PROJECT TITLE
SENECA ARMY DEPOT ACTIVITY
RI/FS
SEAD-16 ABANDONED DEACTIVATION FURNACE

DEPT. ENVIRONMETAL ENGINEERING
Dwg No 729895-01001

FIGURE 4-6
SEAD-16 METALS IN
SURFACE WATER SAMPLES

SCALE 1" = 100'
DATE DECEMBER 1996
REV A

Table 4-24
SEAD-16 Summary Statistics of Sediment Samples

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
VOLATILE ORGANICS								
1,1,1-Trichloroethane	UG/KG	11	0	0%				
1,1,2,2-Tetrachloroethane	UG/KG	11	0	0%				
1,1,2-Trichloroethane	UG/KG	11	0	0%				
1,1-Dichloroethane	UG/KG	11	0	0%				
1,1-Dichloroethene	UG/KG	11	0	0%				
1,2-Dichloroethane	UG/KG	11	0	0%				
1,2-Dichloroethene (total)	UG/KG	11	0	0%				
1,2-Dichloropropane	UG/KG	11	0	0%				
2-Butanone	UG/KG	11	1	9%	12	12	12	0
2-Hexanone	UG/KG	11	0	0%				
4-Methyl-2-Pentanone	UG/KG	11	0	0%				
Acetone	UG/KG	11	6	55%	20	36	24.833	7.223
Benzene	UG/KG	11	0	0%				
Bromodichloromethane	UG/KG	11	0	0%				
Bromoform	UG/KG	11	0	0%				
Bromomethane	UG/KG	11	0	0%				
Carbon Disulfide	UG/KG	11	0	0%				
Carbon Tetrachloride	UG/KG	11	0	0%				
Chlorobenzene	UG/KG	11	0	0%				
Chloroethane	UG/KG	11	0	0%				
Chloroform	UG/KG	11	0	0%				
Chloromethane	UG/KG	11	0	0%				
Dibromochloromethane	UG/KG	11	0	0%				
Ethylbenzene	UG/KG	11	0	0%				
Methylene Chloride	UG/KG	11	0	0%				
Styrene	UG/KG	11	0	0%				
Tetrachloroethene	UG/KG	11	0	0%				
Toluene	UG/KG	11	0	0%				
Trichloroethene	UG/KG	11	0	0%				
Vinyl Chloride	UG/KG	11	0	0%				
Xylene (total)	UG/KG	11	0	0%				
cis-1,3-Dichloropropene	UG/KG	11	0	0%				
trans-1,3-Dichloropropene	UG/KG	11	0	0%				
MIVOLATILE ORGANICS								
Trichlorobenzene	UG/KG	11	0	0%				
orobenzene	UG/KG	11	0	0%				
benzene	UG/KG	11	0	0%				
chlo[illegible]zene	UG/KG	11	0	0%				
Tric[illegible]ol	UG/KG	11	0	0%				

Table 4-24
SEAD-16 Summary Statistics of Sediment Samples

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
2,4,6-Trichlorophenol	UG/KG	11	0	0%				
2,4-Dichlorophenol	UG/KG	11	0	0%				
2,4-Dimethylphenol	UG/KG	11	0	0%				
2,4-Dinitrophenol	UG/KG	11	0	0%				
2,4-Dinitrotoluene	UG/KG	11	3	27%	43	5400	2087.667	2894.753
2,6-Dinitrotoluene	UG/KG	11	0	0%				
2-Chloronaphthalene	UG/KG	11	0	0%				
2-Chlorophenol	UG/KG	11	0	0%				
2-Methylnaphthalene	UG/KG	11	2	18%	40	55	47.5	10.607
2-Methylphenol	UG/KG	11	0	0%				
2-Nitroaniline	UG/KG	11	0	0%				
2-Nitrophenol	UG/KG	11	0	0%				
3,3'-Dichlorobenzidine	UG/KG	11	0	0%				
3-Nitroaniline	UG/KG	11	0	0%				
4,6-Dinitro-2-methylphenol	UG/KG	11	0	0%				
4-Bromophenyl-phenylether	UG/KG	11	0	0%				
4-Chloro-3-methylphenol	UG/KG	11	0	0%				
4-Chloroaniline	UG/KG	11	0	0%				
4-Chlorophenyl-phenylether	UG/KG	11	0	0%				
4-Methylphenol	UG/KG	11	0	0%				
4-Nitroaniline	UG/KG	11	0	0%				
4-Nitrophenol	UG/KG	11	0	0%				
Acenaphthene	UG/KG	11	1	9%	32	32	32	0
Acenaphthylene	UG/KG	11	3	27%	37	54	44	8.888
Anthracene	UG/KG	11	4	36%	42	100	74.5	29.513
Benzo(a)anthracene	UG/KG	11	7	64%	22	570	237.714	188.189
Benzo(a)pyrene	UG/KG	11	6	55%	120	600	316.667	191.485
Benzo(b)fluoranthene	UG/KG	11	6	55%	120	1200	523.333	389.906
Benzo(g,h,i)perylene	UG/KG	11	7	64%	41	530	244.429	176.712
Benzo(k)fluoranthene	UG/KG	11	6	55%	120	780	373.333	250.253
Butylbenzylphthalate	UG/KG	11	0	0%				
Carbazole	UG/KG	11	3	27%	52	110	72	32.924
Chrysene	UG/KG	11	7	64%	36	1200	442.286	394.035
Di-n-butylphthalate	UG/KG	11	4	36%	160	250	195	43.589
Di-n-octylphthalate	UG/KG	11	0	0%				
Dibenz(a,h)anthracene	UG/KG	11	5	45%	38	170	101	59.262
Dibenzofuran	UG/KG	11	0	0%				
Diethylphthalate	UG/KG	11	0	0%				
Dimethylphthalate	UG/KG	11	0	0%				
Fluoranthene	UG/KG	11	8	73%	33	1600	463	505.896

Table 4-24
SEAD-16 Summary Statistics of Sediment Samples

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
Fluorene	UG/KG	11	0	0%				
Hexachlorobenzene	UG/KG	11	0	0%				
Hexachlorobutadiene	UG/KG	11	0	0%				
Hexachlorocyclopentadiene	UG/KG	11	0	0%				
Hexachloroethane	UG/KG	11	0	0%				
Indeno(1,2,3-cd)pyrene	UG/KG	11	7	64%	39	500	228.286	167.882
Isophorone	UG/KG	11	0	0%				
N-Nitroso-di-n-propylamine	UG/KG	11	0	0%				
N-Nitrosodiphenylamine (1)	UG/KG	11	1	9%	600	600	600	0
Naphthalene	UG/KG	11	0	0%				
Nitrobenzene	UG/KG	11	0	0%				
Pentachlorophenol	UG/KG	11	0	0%				
Phenanthrene	UG/KG	11	8	73%	24	420	188.125	147.604
Phenol	UG/KG	11	0	0%				
Pyrene	UG/KG	11	8	73%	30	1400	461.375	452.524
bis(2-Chloroethoxy) methane	UG/KG	11	0	0%				
bis(2-Chloroethyl) ether	UG/KG	11	0	0%				
bis(2-Chloroisopropyl) ether	UG/KG	11	0	0%				
bis(2-Ethylhexyl)phthalate	UG/KG	11	8	73%	27	270	128.875	78.911
PESTICIDES/PCB								
4,4'-DDD	UG/KG	11	8	73%	3	730	116.3	250.399
4,4'-DDE	UG/KG	11	11	100%	3	570	103.3	164.745
4,4'-DDT	UG/KG	11	8	73%	3	420	83.775	139.71
Aldrin	UG/KG	11	0	0%				
Aroclor-1016	UG/KG	11	0	0%				
Aroclor-1221	UG/KG	11	0	0%				
Aroclor-1232	UG/KG	11	0	0%				
Aroclor-1242	UG/KG	11	0	0%				
Aroclor-1248	UG/KG	11	0	0%				
Aroclor-1254	UG/KG	11	7	64%	35	670	160.286	228.185
Aroclor-1260	UG/KG	11	5	45%	39	130	71	35.249
Dieldrin	UG/KG	11	0	0%				
Endosulfan I	UG/KG	11	7	64%	2.3	26	10	7.888
Endosulfan II	UG/KG	11	3	27%	2.6	6.8	5.233	2.294
Endosulfan sulfate	UG/KG	11	2	18%	4.6	18	11.3	9.475
Endrin	UG/KG	11	0	0%				
Endrin aldehyde	UG/KG	11	1	9%	3.2	3.2	3.2	0
Endrin ketone	UG/KG	11	0	0%				
Heptachlor	UG/KG	11	0	0%				
Heptachlor epoxide	UG/KG	11	1	9%	2.8	2.8	2.8	0

Table 4-24
SEAD-16 Summary Statistics of Sediment Samples

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
Methoxychlor	UG/KG	11	0	0%				
Toxaphene	UG/KG	11	0	0%				
alpha-BHC	UG/KG	11	0	0%				
alpha-Chlordane	UG/KG	11	3	27%	4.2	12.1	8.767	4.092
beta-BHC	UG/KG	11	0	0%				
delta-BHC	UG/KG	11	0	0%				
gamma-BHC (Lindane)	UG/KG	11	0	0%				
gamma-Chlordane	UG/KG	11	2	18%	2.9	3.8	3.35	0.636
OTHER ANALYSES								
Nitrate/Nitrite-Nitrogen	MG/KG	11	8	73%	0.03	0.67	0.193	0.205
Percent Moisture (PEST/PCB)		11	11	100%	24	67	40.455	15.009
Percent Moisture (SVOCs)		11	11	100%	24	67	41.364	14.473
Percent Moisture (VOCs)		11	11	100%	23	59	41.818	11.72
Percent Solids (Metals)		11	11	100%	33.1	75.6	59.4	14.873
Total Organic Carbon	MG/KG	11	11	100%	2780	62500	36475.46	21732.18
NITROAROMATICS								
1,3,5-Trinitrobenzene	UG/KG	11	0	0%				
1,3-Dinitrobenzene	UG/KG	11	0	0%				
2,4,6-Trinitrotoluene	UG/KG	11	0	0%				
2,4-Dinitrotoluene	UG/KG	11	2	18%	190	910	550	509.117
2,6-Dinitrotoluene	UG/KG	11	0	0%				
2-Nitrotoluene	UG/KG	11	0	0%				
2-amino-4,6-Dinitrotoluene	UG/KG	11	0	0%				
3-Nitrotoluene	UG/KG	11	0	0%				
4-Nitrotoluene	UG/KG	11	0	0%				
4-amino-2,6-Dinitrotoluene	UG/KG	11	0	0%				
HMX	UG/KG	11	0	0%				
Nitrobenzene	UG/KG	11	0	0%				
RDX	UG/KG	11	0	0%				
Tetryl	UG/KG	11	0	0%				
METALS								
Aluminum	MG/KG	11	11	100%	6430	22900	13470	5215.233
Antimony	MG/KG	11	10	91%	1.4	50.3	13.73	15.701
Arsenic	MG/KG	11	11	100%	1.9	9.6	5.936	2.317
Barium	MG/KG	11	11	100%	27.8	3980	555.764	1150.458
Beryllium	MG/KG	11	11	100%	0.24	0.93	0.558	0.206
Cadmium	MG/KG	11	11	100%	0.23	7.6	1.441	2.116
Calcium	MG/KG	11	11	100%	6680	75700	37316.36	23078.96
Chromium	MG/KG	11	11	100%	10.8	43.5	26.964	10.473
Cobalt	MG/KG	11	11	100%	6.5	15.6	10.073	3.045

Table 4-24
SEAD-16 Summary Statistics of Sediment Samples

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Parameter	**Units**	**Total Count**	**Hit Count**	**Frequency**	**Min. Conc.**	**Max. Conc.**	**Average**	**Standard Deviation**
Copper	MG/KG	11	11	100%	27.4	17500	1777.582	5217.143
Cyanide	MG/KG	11	0	0%				
Iron	MG/KG	11	11	100%	15300	46400	27545.46	9569.05
Lead	MG/KG	11	11	100%	112	4480	1363.636	1309.433
Magnesium	MG/KG	11	11	100%	3200	15100	7873.636	3459.559
Manganese	MG/KG	11	11	100%	174	447	277.091	94.154
Mercury	MG/KG	11	11	100%	0.06	2.5	0.564	0.852
Nickel	MG/KG	11	11	100%	18.2	50.9	33.727	10.248
Potassium	MG/KG	11	11	100%	557	3870	2047.909	899.105
Selenium	MG/KG	11	2	18%	1.4	4.9	3.15	2.475
Silver	MG/KG	11	1	9%	0.35	0.35	0.35	0
Sodium	MG/KG	11	11	100%	68.6	782	240.7	210.128
Thallium	MG/KG	11	2	18%	1	1.6	1.3	0.424
Vanadium	MG/KG	11	11	100%	8.9	39.8	24.955	9.793
Zinc	MG/KG	11	11	100%	96.3	952	335.755	259.712

Table 4-25
SEAD-16 Summary of Analytes Detected in Sediment

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SW/SD16-1		SW/SD16-10		SW/SD16-2		SW/SD16-3		SW/SD16-4	
			SAMP ID:	16143A		16129A		16135A		16133A		16119A	
			QC CODE:	SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0	
			BOTTOM:	6		6		6		6		6	
			MATRIX:	SEDIMENT		SEDIMENT		SEDIMENT		SEDIMENT		SEDIMENT	
			SAMPLE DATE:	9/18/96		9/18/96		9/18/96		9/18/96		9/18/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
VOLATILE ORGANICS													
2-Butanone			UG/KG	24	U	18	U	17	U	21	U	22	U
Acetone			UG/KG	37	U	20		17	U	21	U	21	J
SEMIVOLATILE ORGANICS													
2,4-Dinitrotoluene			UG/KG	5400		620	U	720	U	480	U	430	UJ
2-Methylnaphthalene			UG/KG	850	U	620	U	55	J	480	U	430	UJ
Acenaphthene	5110	NYS BALCT	UG/KG	850	U	32	J	720	U	480	U	430	UJ
Acenaphthylene			UG/KG	54	J	620	U	41	J	480	U	430	UJ
Anthracene			UG/KG	99	J	57	J	42	J	480	U	430	UJ
Benzo(a)anthracene	47.45	NYS HHB	UG/KG	**570**	**J**	**260**	**J**	**240**	**J**	480	U	430	UJ
Benzo(a)pyrene	47.45	NYS HHB	UG/KG	**600**	**J**	**320**	**J**	**270**	**J**	480	U	430	UJ
Benzo(b)fluoranthene	47.45	NYS HHB	UG/KG	**1200**		**480**	**J**	**450**	**J**	480	U	430	UJ
Benzo(g,h,i)perylene			UG/KG	530	J	280	J	250	J	41	J	430	UJ
Benzo(k)fluoranthene	47.45	NYS HHB	UG/KG	**780**	**J**	**320**	**J**	**370**	**J**	480	U	430	UJ
Carbazole			UG/KG	110	J	52	J	720	U	480	U	430	UJ
Chrysene	47.45	NYS HHB	UG/KG	**1200**		**440**	**J**	**440**	**J**	480	U	430	UJ
Di-n-butylphthalate			UG/KG	250	J	210	J	720	U	480	U	430	UJ
Dibenz(a,h)anthracene			UG/KG	170	J	100	J	720	U	480	U	430	UJ
Fluoranthene	37230	NYS BALCT	UG/KG	1600		550	J	490	J	33	J	430	UJ
Indeno(1,2,3-cd)pyrene	47.45	NYS HHB	UG/KG	**500**	**J**	**250**	**J**	**240**	**J**	39	J	430	UJ

Note: Shaded values exceed the NYS BACLT, HHB, or LEL criteria.

Table 4-25
SEAD-16 Summary of Analytes Detected in Sediment

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SW/SD16-1		SW/SD16-10		SW/SD16-2		SW/SD16-3		SW/SD16-4	
			SAMP ID:	16143A		16129A		16135A		16133A		16119A	
			QC CODE:	SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0	
			BOTTOM:	6		6		6		6		6	
			MATRIX:	SEDIMENT		SEDIMENT		SEDIMENT		SEDIMENT		SEDIMENT	
			SAMPLE DATE:	9/18/96		9/18/96		9/18/96		9/18/96		9/18/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
N-Nitrosodiphenylamine (1)			UG/KG	600	J	620	U	720	U	480	U	430	UJ
Phenanthrene	4380	NYS BALCT	UG/KG	420	J	340	J	140	J	31	J	430	UJ
Pyrene			UG/KG	1400		620	J	510	J	30	J	430	UJ
bis(2-Ethylhexyl)phthalate	7300	NYS BALCT	UG/KG	180	J	270	J	720	U	120	J	27	J
PESTICIDES/PCB													
4,4'-DDD	0.37	NYS HHB	UG/KG	**730**	**J**	**61**		**4.4**	**J**	**3**	**J**	4.3	U
4,4'-DDE	0.37	NYS HHB	UG/KG	**570**	**J**	**150**		**13**	**J**	**32**		**3**	**J**
4,4'-DDT	0.37	NYS HHB	UG/KG	**420**	**J**	**54**		**5.3**	**J**	4.9	U	4.3	U
Aroclor-1254	0.03	NYS HHB	UG/KG	**670**		**100**	**J**	72	U	**41**	**J**	43	U
Aroclor-1260	0.03	NYS HHB	UG/KG	**130**	**J**	**72**	**J**	72	U	**39**	**J**	43	U
Endosulfan I	1.10	NYS BALCT	UG/KG	**26**		**8.8**		**11**	**J**	**2.3**	**J**	2.2	U
Endosulfan II	1.10	NYS BALCT	UG/KG	8.5	U	**6.3**	**J**	7.2	U	4.9	U	**2.6**	**J**
Endosulfan sulfate			UG/KG	18	J	6.2	U	7.2	U	4.9	U	4.3	U
Endrin aldehyde			UG/KG	8.5	U	6.2	U	7.2	U	3.2	J	4.3	U
Heptachlor epoxide	0.03	NYS HHB	UG/KG	4.4	U	3.2	U	**2.8**	**J**	2.5	U	2.2	U
alpha-Chlordane			UG/KG	10	J	3.2	U	3.7	U	2.5	U	2.2	U
gamma-Chlordane			UG/KG	4.4	U	3.2	U	3.7	U	2.5	U	2.2	U
OTHER ANALYSES													
Nitrate/Nitrite-Nitrogen			MG/KG	0.67		0.09		0.24		0.01	U	0.01	U
Percent Moisture (PEST/PCB)				61		47		54		32		24	

Note: Shaded values exceed the NYS BACLT, HHB, or LEL criteria.

Table 4-25

SEAD-16 Summary of Analytes Detected in Sediment

SEAD-16 Remedial Investigation

Seneca Army Depot Activity

			LOC_ID:	SW/SD16-1		SW/SD16-10		SW/SD16-2		SW/SD16-3		SW/SD16-4	
			SAMP ID:	16143A		16129A		16135A		16133A		16119A	
			QC CODE:	SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0	
			BOTTOM:	6		6		6		6		6	
			MATRIX:	SEDIMENT		SEDIMENT		SEDIMENT		SEDIMENT		SEDIMENT	
			SAMPLE DATE:	9/18/96		9/18/96		9/18/96		9/18/96		9/18/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Percent Moisture (SVOCs)				61		47		54		32		24	
Percent Moisture (VOCs)				59		44		40		52		54	
Percent Solids (Metals)				38.9		52.8		46.2		67.8		75.5	
Total Organic Carbon			MG/KG	62500		56600		30300		28900		7150	
NITROAROMATICS													
2,4-Dinitrotoluene			UG/KG	190	J	120	U	120	UJ	120	U	120	U
METALS													
Aluminum			MG/KG	11000	J	14300		22900	J	8040		6430	J
Antimony	2	NSY LEL	MG/KG	**10.9**	**J**	**11.5**	**J**	**13.5**	**J**	**50.3**	**J**	1.4	J
Arsenic	6	NSY LEL	MG/KG	**8.7**	**J**	**9.6**		**7.2**	**J**	4.5		3.4	J
Barium			MG/KG	109	J	636		242	J	433		27.8	J
Beryllium			MG/KG	0.46	J	0.69		0.93	J	0.41		0.24	J
Cadmium	0.6	NSY LEL	MG/KG	**1.6**	**J**	**7.6**		**0.72**	**J**	0.57		0.24	J
Calcium			MG/KG	75700	J	38300		13400	J	26400		19200	J
Chromium	26	NSY LEL	MG/KG	**43.5**	**J**	**41.3**		**32.9**	**J**	20.4		10.8	J
Cobalt			MG/KG	7.6	J	13.6		13.1	J	7.6		6.5	J
Copper	16	NSY LEL	MG/KG	**335**	**J**	**573**	**J**	**260**	**J**	**17500**	**J**	**27.4**	**J**
Iron	20000	NSY LEL	MG/KG	**28500**	**J**	**46400**		**34300**	**J**	**20400**		15300	J
Lead	31	NSY LEL	MG/KG	**1720**	**J**	**1950**		**1250**	**J**	**4480**		**175**	**J**
Magnesium			MG/KG	12300	J	8390		7500	J	4720		3200	J

Note: Shaded values exceed the NYS BACLT, HHB, or LEL criteria.

Table 4-25
SEAD-16 Summary of Analytes Detected in Sediment

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SW/SD16-1		SW/SD16-10		SW/SD16-2		SW/SD16-3		SW/SD16-4	
			SAMP ID:	16143A		16129A		16135A		16133A		16119A	
			QC CODE:	SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0	
			BOTTOM:	6		6		6		6		6	
			MATRIX:	SEDIMENT		SEDIMENT		SEDIMENT		SEDIMENT		SEDIMENT	
			SAMPLE DATE:	9/18/96		9/18/96		9/18/96		9/18/96		9/18/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Manganese	460	NSY LEL	MG/KG	218	J	386	J	174	J	217	J	186	J
Mercury	0.15	NSY LEL	MG/KG	**0.52**	**J**	**0.31**		**2**	**J**	**2.5**		0.08	J
Nickel	16	NSY LEL	MG/KG	**32.6**	**J**	**45.2**	**J**	**44.8**	**J**	**32.4**	**J**	**18.2**	**J**
Potassium			MG/KG	2420	J	2440	J	2660	J	880	J	557	J
Selenium			MG/KG	4.9	J	1.5	U	1.7	UJ	1.1	U	0.7	UJ
Silver	1	NSY LEL	MG/KG	0.69	UJ	0.48	U	0.53	UJ	0.35		0.22	UJ
Sodium			MG/KG	153	J	782		182	J	404		69.1	J
Thallium			MG/KG	1.9	UJ	1.3	U	1.6	J	0.94	U	0.61	UJ
Vanadium			MG/KG	39.8	J	29.3		33.5	J	10		8.9	J
Zinc	120	NSY LEL	MG/KG	**549**	**J**	**557**		**339**	**J**	**952**		**138**	**J**

Note: Shaded values exceed the NYS BACLT, HHB, or LEL criteria.

Table 4-25
SEAD-16 Summary of Analytes Detected in Sediment

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SW/SD16-4		SW/SD16-5		SW/SD16-6		SW/SD16-7		SW/SD16-8	
			SAMP ID:	16125A		16142A		16126A		16127A		16134A	
			QC CODE:	DU		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0	
			BOTTOM:	6		6		6		6		6	
			MATRIX:	SEDIMENT		SEDIMENT		SEDIMENT		SEDIMENT		SEDIMENT	
			SAMPLE DATE:	9/18/96		9/18/96		9/18/96		9/18/96		9/18/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
VOLATILE ORGANICS													
2-Butanone			UG/KG	16	U	13	U	14	U	14	U	16	U
Acetone			UG/KG	20		13	U	36		20		16	U
SEMIVOLATILE ORGANICS													
2,4-Dinitrotoluene			UG/KG	1000	UJ	430	U	820		43	J	470	U
2-Methylnaphthalene			UG/KG	1000	UJ	430	U	40	J	570	U	470	U
Acenaphthene	5110	NYS BALCT	UG/KG	1000	UJ	430	U	530	U	570	U	470	U
Acenaphthylene			UG/KG	1000	UJ	430	U	530	U	570	U	470	U
Anthracene			UG/KG	1000	UJ	430	U	530	U	570	U	470	U
Benzo(a)anthracene	47.45	NYS HHB	UG/KG	1000	UJ	430	U	**110**	**J**	**92**	**J**	22	J
Benzo(a)pyrene	47.45	NYS HHB	UG/KG	1000	UJ	430	U	**120**	**J**	**120**	**J**	470	U
Benzo(b)fluoranthene	47.45	NYS HHB	UG/KG	1000	UJ	430	U	**200**	**J**	**120**	**J**	470	U
Benzo(g,h,i)perylene			UG/KG	1000	UJ	430	U	110	J	100	J	470	U
Benzo(k)fluoranthene	47.45	NYS HHB	UG/KG	1000	UJ	430	U	**130**	**J**	**120**	**J**	470	U
Carbazole			UG/KG	1000	UJ	430	U	530	U	570	U	470	U
Chrysene	47.45	NYS HHB	UG/KG	1000	UJ	430	U	**220**	**J**	**120**	**J**	36	J
Di-n-butylphthalate			UG/KG	1000	UJ	430	U	160	J	570	U	470	U
Dibenz(a,h)anthracene			UG/KG	1000	UJ	430	U	38	J	47	J	470	U
Fluoranthene	37230	NYS BALCT	UG/KG	1000	UJ	430	U	250	J	190	J	41	J
Indeno(1,2,3-cd)pyrene	47.45	NYS HHB	UG/KG	1000	UJ	430	U	**98**	**J**	**91**	**J**	470	U

Note: Shaded values exceed the NYS BACLT, HHB, or LEL criteria.

Table 4-25
SEAD-16 Summary of Analytes Detected in Sediment

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SW/SD16-4		SW/SD16-5		SW/SD16-6		SW/SD16-7		SW/SD16-8	
			SAMP ID:	16125A		16142A		16126A		16127A		16134A	
			QC CODE:	DU		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0	
			BOTTOM:	6		6		6		6		6	
			MATRIX:	SEDIMENT		SEDIMENT		SEDIMENT		SEDIMENT		SEDIMENT	
			SAMPLE DATE:	9/18/96		9/18/96		9/18/96		9/18/96		9/18/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
N-Nitrosodiphenylamine (1)			UG/KG	1000	UJ	430	U	530	U	570	U	470	U
Phenanthrene	4380	NYS BALCT	UG/KG	1000	UJ	430	U	150	J	100	J	24	J
Pyrene			UG/KG	1000	UJ	430	U	240	J	190	J	41	J
bis(2-Ethylhexyl)phthalate	7300	NYS BALCT	UG/KG	160	J	430	U	73	J	150	J	470	U
PESTICIDES/PCB													
4,4'-DDD	0.37	NYS HHB	UG/KG	10	UJ	4.3	U	**11**	**J**	**100**	**J**	**3**	**J**
4,4'-DDE	0.37	NYS HHB	UG/KG	**15**	**J**	**4.3**	**J**	**120**	**J**	**140**	**J**	**13**	
4,4'-DDT	0.37	NYS HHB	UG/KG	**7.9**	**J**	4.3	U	**31**		**100**	**J**	**3**	**J**
Aroclor-1254	0.03	NYS HHB	UG/KG	100	UJ	43	U	**65**	**J**	**150**		**35**	**J**
Aroclor-1260	0.03	NYS HHB	UG/KG	100	UJ	43	U	36	U	**51**	**J**	47	U
Endosulfan I	1.10	NYS BALCT	UG/KG	5.2	UJ	2.2	U	**5.5**	**J**	**4.4**	**J**	2.4	U
Endosulfan II	1.10	NYS BALCT	UG/KG	**6.8**	**J**	4.3	U	4.6	U	5.7	U	4.7	U
Endosulfan sulfate			UG/KG	10	UJ	4.3	U	2.7	U	4.6	J	4.7	U
Endrin aldehyde			UG/KG	10	UJ	4.3	U	3.2	U	5.7	U	4.7	U
Heptachlor epoxide	0.03	NYS HHB	UG/KG	5.2	UJ	2.2	U	2.4	U	2.9	U	2.4	U
alpha-Chlordane			UG/KG	5.2	UJ	2.2	U	2.4	U	4.2		2.4	U
gamma-Chlordane			UG/KG	5.2	UJ	2.2	U	1.4	U	3.8		2.4	U
OTHER ANALYSES													
Nitrate/Nitrite-Nitrogen			MG/KG	0.03	U	0.12		0.14		0.03		0.2	
Percent Moisture (PEST/PCB)				67		24		28		42		30	

Note: Shaded values exceed the NYS BACLT, HHB, or LEL criteria.

Table 4-25
SEAD-16 Summary of Analytes Detected in Sediment

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SW/SD16-4		SW/SD16-5		SW/SD16-6		SW/SD16-7		SW/SD16-8	
			SAMP ID:	16125A		16142A		16126A		16127A		16134A	
			QC CODE:	DU		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0	
			BOTTOM:	6		6		6		6		6	
			MATRIX:	SEDIMENT		SEDIMENT		SEDIMENT		SEDIMENT		SEDIMENT	
			SAMPLE DATE:	9/18/96		9/18/96		9/18/96		9/18/96		9/18/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Percent Moisture (SVOCs)				67		24		38		42		30	
Percent Moisture (VOCs)				39		23		28		31		37	
Percent Solids (Metals)				33.1		75.6		71.8		57.7		70	
Total Organic Carbon			MG/KG	56800		2780		19400		50600		26400	
NITROAROMATICS													
2,4-Dinitrotoluene			UG/KG	120	UJ	120	U	910	J	120	U	120	U
METALS													
Aluminum			MG/KG	11400	J	17500		19500		10200		17300	
Antimony	2	NSY LEL	MG/KG	**8.7**	**J**	0.77	UJ	**32.2**	**J**	**3.2**	**J**	**2.6**	**J**
Arsenic	6	NSY LEL	MG/KG	**6.1**	**J**	5.6		**7.6**		1.9		**6.5**	
Barium			MG/KG	92	J	99.9		3980		62.7		300	
Beryllium			MG/KG	0.39	J	0.73		0.78		0.42		0.61	
Cadmium	0.6	NSY LEL	MG/KG	**0.61**	**J**	0.26		**0.92**		**1.9**		0.23	
Calcium			MG/KG	43500	J	72700		30900		25700		6680	
Chromium	26	NSY LEL	MG/KG	18.3	J	**27.8**		**36.2**		23.5		25	
Cobalt			MG/KG	11.8	J	10.6		15.6		7.5		8	
Copper	16	NSY LEL	MG/KG	**116**	**J**	**50**	**J**	**363**	**J**	**120**	**J**	**85**	**J**
Iron	20000	NSY LEL	MG/KG	**23200**	**J**	**31000**		**31700**		17700		**36400**	
Lead	31	NSY LEL	MG/KG	**634**	**J**	**112**		**2700**		**511**		**992**	
Magnesium			MG/KG	5700	J	8350		9430		6660		5260	

Note: Shaded values exceed the NYS BACLT, HHB, or LEL criteria.

Table 4-25
SEAD-16 Summary of Analytes Detected in Sediment

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SW/SD16-4		SW/SD16-5		SW/SD16-6		SW/SD16-7		SW/SD16-8	
			SAMP ID:	16125A		16142A		16126A		16127A		16134A	
			QC CODE:	DU		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0	
			BOTTOM:	6		6		6		6		6	
			MATRIX:	SEDIMENT		SEDIMENT		SEDIMENT		SEDIMENT		SEDIMENT	
			SAMPLE DATE:	9/18/96		9/18/96		9/18/96		9/18/96		9/18/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Manganese	460	NSY LEL	MG/KG	343	J	303		359	J	192	J	223	J
Mercury	0.15	NSY LEL	MG/KG	**0.2**	**J**	0.08		**0.23**		0.06		0.06	
Nickel	16	NSY LEL	MG/KG	**30**	**J**	**40.1**	**J**	**50.9**	**J**	**27.3**	**J**	**24.8**	**J**
Potassium			MG/KG	1630	J	2450	J	3870	J	1970	J	1640	J
Selenium			MG/KG	1.8	UJ	1	U	1.4		1.6	U	0.76	U
Silver	1	NSY LEL	MG/KG	0.58	UJ	0.32	U	0.28	U	0.5	U	0.24	U
Sodium			MG/KG	147	J	142		197		127		68.6	
Thallium			MG/KG	1.6	UJ	0.88	U	1		1.4	U	0.66	U
Vanadium			MG/KG	18.3	J	26.6		34.3		26.5		27.2	
Zinc	120	NSY LEL	MG/KG	**284**	**J**	103		**307**		**176**		96.3	

Note: Shaded values exceed the NYS BACLT, HHB, or LEL criteria.

Table 4-25
SEAD-16 Summary of Analytes Detected in Sediment

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SW/SD16-9	
			SAMP ID:	16128A	
			QC CODE:	SA	
			STUDY ID:	RI ROUND1	
			TOP:	0	
			BOTTOM:	6	
			MATRIX:	SEDIMENT	
			SAMPLE DATE:	9/18/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q
VOLATILE ORGANICS					
2-Butanone			UG/KG	12	J
Acetone			UG/KG	32	
SEMIVOLATILE ORGANICS					
2,4-Dinitrotoluene			UG/KG	520	U
2-Methylnaphthalene			UG/KG	520	U
Acenaphthene	5110	NYS BALCT	UG/KG	520	U
Acenaphthylene			UG/KG	37	J
Anthracene			UG/KG	100	J
Benzo(a)anthracene	47.45	NYS HHB	UG/KG	**370**	**J**
Benzo(a)pyrene	47.45	NYS HHB	UG/KG	**470**	**J**
Benzo(b)fluoranthene	47.45	NYS HHB	UG/KG	**690**	
Benzo(g,h,i)perylene			UG/KG	400	J
Benzo(k)fluoranthene	47.45	NYS HHB	UG/KG	**520**	
Carbazole			UG/KG	54	J
Chrysene	47.45	NYS HHB	UG/KG	**640**	
Di-n-butylphthalate			UG/KG	160	J
Dibenz(a,h)anthracene			UG/KG	150	J
Fluoranthene	37230	NYS BALCT	UG/KG	550	
Indeno(1,2,3-cd)pyrene	47.45	NYS HHB	UG/KG	**380**	**J**

Note: Shaded values exceed the NYS BACLT, HHB, or LEL criteria.

Table 4-25
SEAD-16 Summary of Analytes Detected in Sediment

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SW/SD16-9	
			SAMP ID:	16128A	
			QC CODE:	SA	
			STUDY ID:	RI ROUND1	
			TOP:	0	
			BOTTOM:	6	
			MATRIX:	SEDIMENT	
			SAMPLE DATE:	9/18/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q
N-Nitrosodiphenylamine (1)			UG/KG	520	U
Phenanthrene	4380	NYS BALCT	UG/KG	300	J
Pyrene			UG/KG	660	
bis(2-Ethylhexyl)phthalate	7300	NYS BALCT	UG/KG	51	J
PESTICIDES/PCB					
4,4'-DDD	0.37	NYS HHB	UG/KG	**18**	**J**
4,4'-DDE	0.37	NYS HHB	UG/KG	**76**	
4,4'-DDT	0.37	NYS HHB	UG/KG	**49**	
Aroclor-1254	0.03	NYS HHB	UG/KG	**61**	**J**
Aroclor-1260	0.03	NYS HHB	UG/KG	**63**	**J**
Endosulfan I	1.10	NYS BALCT	UG/KG	**12**	
Endosulfan II	1.10	NYS BALCT	UG/KG	5.2	U
Endosulfan sulfate			UG/KG	3	U
Endrin aldehyde			UG/KG	5.2	U
Heptachlor epoxide	0.03	NYS HHB	UG/KG	2.7	U
alpha-Chlordane			UG/KG	12.1	J
gamma-Chlordane			UG/KG	2.9	
OTHER ANALYSES					
Nitrate/Nitrite-Nitrogen			MG/KG	0.05	
Percent Moisture (PEST/PCB)				36	

Note: Shaded values exceed the NYS BACLT, HHB, or LEL criteria.

Table 4-25
SEAD-16 Summary of Analytes Detected in Sediment

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SW/SD16-9	
			SAMP ID:	16128A	
			QC CODE:	SA	
			STUDY ID:	RI ROUND1	
			TOP:	0	
			BOTTOM:	6	
			MATRIX:	SEDIMENT	
			SAMPLE DATE:	9/18/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q
Percent Moisture (SVOCs)				36	
Percent Moisture (VOCs)				53	
Percent Solids (Metals)				64	
Total Organic Carbon			MG/KG	59800	
NITROAROMATICS					
2,4-Dinitrotoluene			UG/KG	120	U
METALS					
Aluminum			MG/KG	9600	
Antimony	2	NSY LEL	MG/KG	3	J
Arsenic	6	NSY LEL	MG/KG	4.2	
Barium			MG/KG	131	
Beryllium			MG/KG	0.48	
Cadmium	0.6	NSY LEL	MG/KG	1.2	
Calcium			MG/KG	58000	
Chromium	26	NSY LEL	MG/KG	16.9	
Cobalt			MG/KG	8.9	
Copper	16	NSY LEL	MG/KG	124	J
Iron	20000	NSY LEL	MG/KG	18100	
Lead	31	NSY LEL	MG/KG	476	
Magnesium			MG/KG	15100	

Note: Shaded values exceed the NYS BACLT, HHB, or LEL criteria.

Table 4-25
SEAD-16 Summary of Analytes Detected in Sediment

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SW/SD16-9	
			SAMP ID:	16128A	
			QC CODE:	SA	
			STUDY ID:	RI ROUND1	
			TOP:	0	
			BOTTOM:	6	
			MATRIX:	SEDIMENT	
			SAMPLE DATE:	9/18/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q
Manganese	460	NSY LEL	MG/KG	447	J
Mercury	0.15	NSY LEL	MG/KG	**0.16**	
Nickel	16	NSY LEL	MG/KG	**24.7**	**J**
Potassium			MG/KG	2010	J
Selenium			MG/KG	0.98	U
Silver	1	NSY LEL	MG/KG	0.31	U
Sodium			MG/KG	376	
Thallium			MG/KG	0.85	U
Vanadium			MG/KG	20.1	
Zinc	120	NSY LEL	MG/KG	**192**	

Note: Shaded values exceed the NYS BACLT, HHB, or LEL criteria.

Table 4-26

VOCs and TICs in Sediment (ug/Kg)

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Sediment Sampling Location	Sediment Sample ID	Study ID	Total TCL VOCs	Total TICs	Total All VOCs
SW/SD16-1	16143A	Round I	0	360	360
SW/SD16-2	16135A	Round I	0	0	0
SW/SD16-3	16133A	Round I	0	0	0
SW/SD16-4	16119A	Round I	21	16	37
SW/SD16-4	16125A (1)	Round I	20	24	44
SW/SD16-5	16142A	Round I	0	0	0
SW/SD16-6	16126A	Round I	36	31	67
SW/SD16-7	16127A	Round I	20	308	328
SW/SD16-8	16134A	Round I	0	0	0
SW/SD16-9	16128A	Round I	44	0	44
SW/SD16-10	16129A	Round I	20	0	20

(1) Sample 16125A is a duplicate of sample 16119A at location SW/SD16-4.

Benzo(a)anthrancene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene were detected in six sediment samples at concentrations above their respective NYS HHB criteria. Exceedences were detected in samples SW/SD16-1, SW/SD16-2, SW/SD16-6, SW/SD16-7, SW/SD16-9, AND SW/SD16-10. No other detected semi-volatile compounds exceeded their guidance level.

Several of the PAH compounds are considered to be carcinogenic. Maximum total carcinogenic PAH concentrations of 5,020 μg/kg, 3,220 μg/kg, 2,170 μg/kg, and 2,010 μg/kg were detected in samples SW/SD16-1, SW/SD16-9, SW/SD16-10, and SW/SD16-2. Figure 4-7 shows the distribution of total carcinogenic PAH concentrations in the sediment sample locations.

The following samples had detection limits which exceeded the TAGM values for six PAH compounds: SWSD16-3, SW/SD16-4, SW/SD16-5, SW/SD16-6, AND SW/SD16-8.

TICs were found in nearly all of the sediment samples at SEAD-16 (Table 4-27). The highest concentration was found in the sample collected from the northeastern corner of Building S-311. Sample SW/SD16-1 contained a concentration of 66,750 μg/kg. Other samples with high concentrations of TICs were SW/SD16-4 and SW/SD16-10, which are located near the railroad tracks south and north, respectively, of Building S-311. These samples had concentrations of TICs of 35,470 μg /kg and 35,660 μg /kg, respectively.

4.1.7.3 Pesticides and PCBs

A total of ten pesticides were detected in the sediment samples collected at SEAD-16 and six of these compounds exceeded their respective NYS HHB or BALCT sediment criteria values (Table 4-25). The most significant exceedences for these compounds were for the sediment sample SW/SD16-1, which was collected from the drainage ditch at the northern portion of the site.

4,4-DDE was detected in 11 samples at concentrations exceeding the NYS HHB criteria value of 0.37 μg/kg. A maximum concentration of 570 μg/kg was detected in sample SW/SD16-1. 4,4-DDD and 4,4-DDT were both detected in eight samples at concentrations above the NYS HHB criteria value. The maximum concentration of each compound was detected in SW/SD16-1. Endosulfan I was detected in seven samples at concentrations above the NYS BALCT criteria value of 1.1 μg/kg. The maximum concentration of 130 J μg/kg was again detected in sample SW/SD16-1. The remaining two pesticides, Endosulfan II and Heptachlor epoxide, were detected above their respective criteria in three and one sample, respectively.

Two PCB compounds were detected in the sediment samples. Aroclor-1254 was detected in seven samples at concentrations above the NYS HHB criteria of 0.03 μg/kg. Aroclor-1260 was detected in five samples at concentrations above the NYS HHB criteria of 0.03 µg/kg. The maximum concentrations of both compounds were detected in sample SW/SD16-1.

Detection limits for most samples were above the TAGM values, which were low values of 1.1 µg/kg or below.

4.1.7.4 Nitroaromatics

The nitroaromatic compound, 2,4-dinitrotoluene, was detected at two of the 11 sediment sample locations at SEAD-16 (Table 4-25). The detected concentrations were 190 J µg /kg and 910 µg /kg; the maximum was found in SW/SD16-6, which is located in the drainage ditch southwest of the Abandoned Deactivation Furnace. There is no NYSDEC criteria value for this compound.

4.1.7.5 Herbicides

Herbicides were not part of the laboratory analytical suite for the sediment at SEAD-16.

4.1.7.6 Metals

Metals were detected in all 11 sediment samples collected at the site (Table 4-25). New York State lowest effect levels (LELs), as defined in Technical Guidance for Screening of Contaminated Sediments (NYSDEC, 1993) were used as a basis of comparison of metals concentrations in for the sediment samples.

Ten metals (antimony, arsenic, cadmium, chromium, copper, iron, lead, mercury, nickel, and zinc) were found to exceed the LEL criteria. It is noteworthy that the highest concentrations for most of the metals that exceeded their respective LEL standards were detected at SW/SD16-3 and SW/SD16-10. SW/SD16-3, which is located in the drainage ditch in the southeastern portion of the site, had the maximum concentrations of antimony, copper, lead, mercury, and zinc. SW/SD16-10 had the maximum concentrations of arsenic, cadmium, and iron. This sediment sample was located in the northeastern portion of the site adjacent to the railroad tracks. Figure 4-8 shows the distribution of lead, mercury. and zinc in the sediment sample locations.

All detection limits for the metals were below the respective TAGM values.

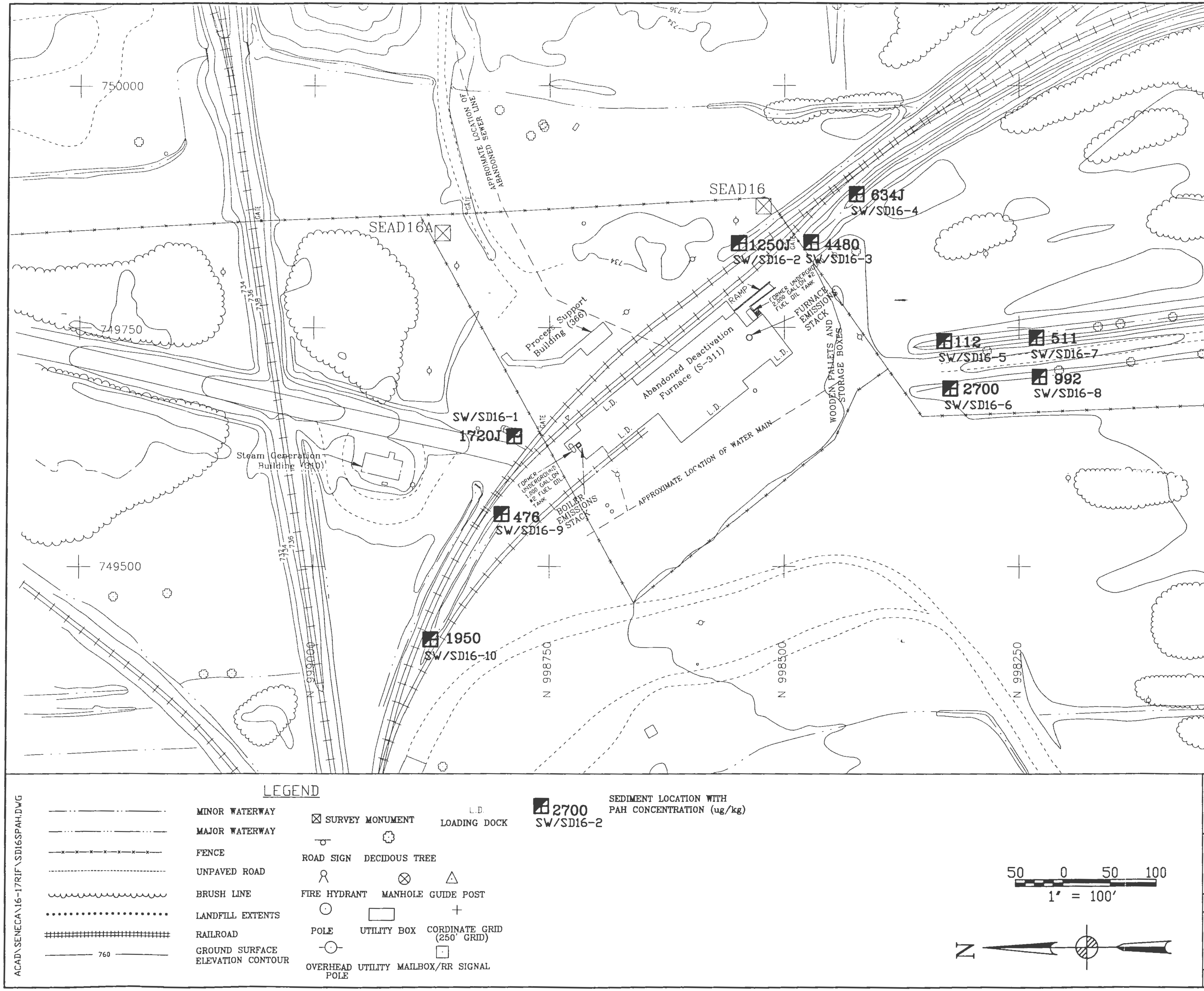
Table 4-27

SVOCs and TICs in Sediment (ug/Kg)

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Sediment Sampling Location	Sediment Sample ID	Study ID	Total TCL SVOCs	Total TICs	Total All SVOCs
SW/SD16-1	16143A	Round I	15663	66750	82413
SW/SD16-2	16135A	Round I	3538	25550	29088
SW/SD16-3	16133A	Round I	294	12640	12934
SW/SD16-4	16119A	Round I	27	10760	10787
SW/SD16-4	16125A (1)	Round I	160	35470	35630
SW/SD16-5	16142A	Round I	0	8250	8250
SW/SD16-6	16126A	Round I	2759	23780	26539
SW/SD16-7	16127A	Round I	1483	21540	23023
SW/SD16-8	16134A	Round I	164	11010	11174
SW/SD16-9	16128A	Round I	5532	16350	21882
SW/SD16-10	16129A	Round I	4581	35660	40241

(1) Sample 16125A is a duplicate of sample 16119A at location SW/SD16-4.



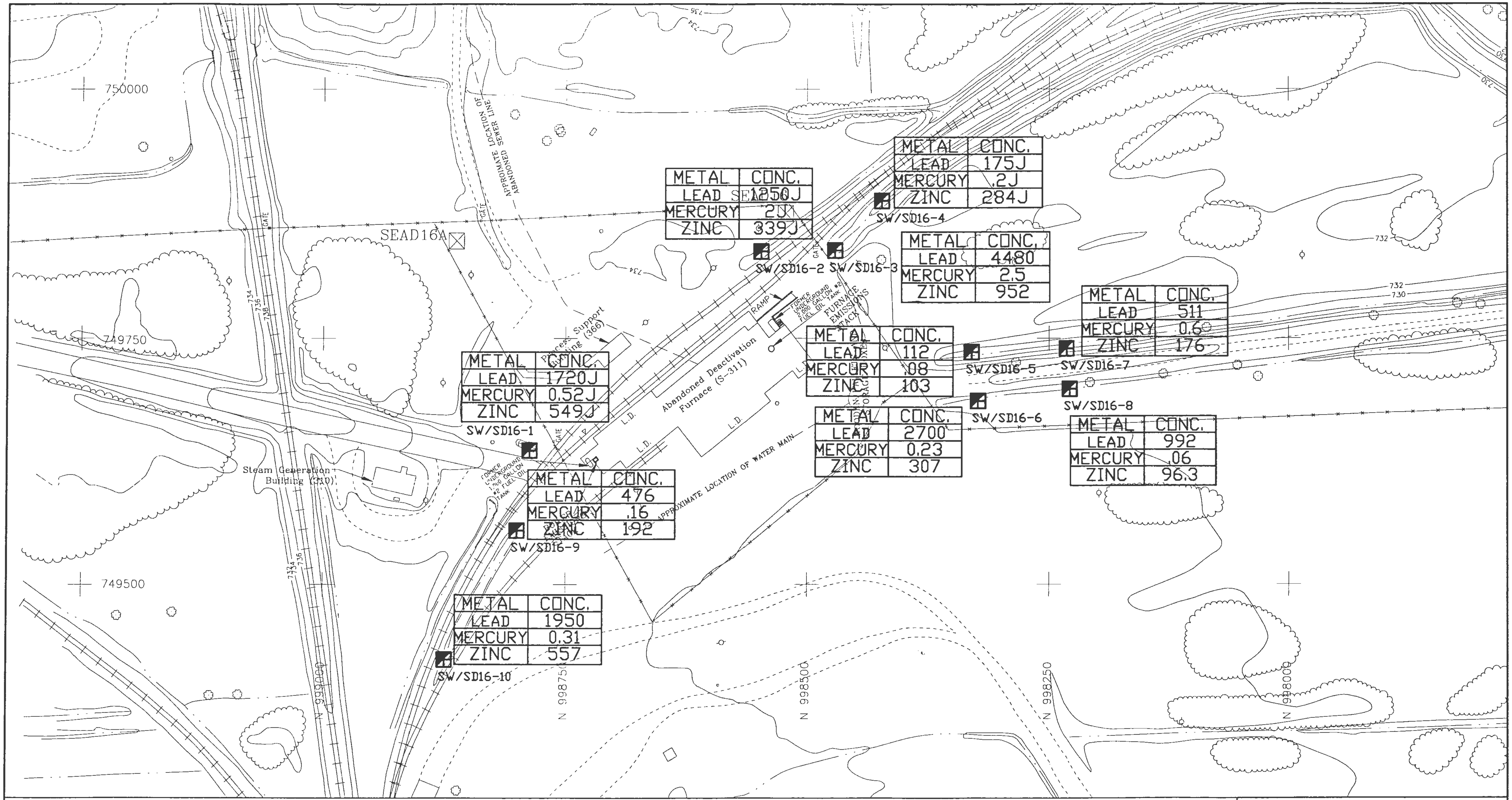
PARSONS
PARSONS ENGINEERING SCIENCE, INC.

CLIENT/PROJECT TITLE
SENECA ARMY DEPOT ACTIVITY
RI/FS
SEAD-16 ABANDONED DEACTIVATION FURNACE

DEPT.	Dwg. No.
ENVIRONMETAL ENGINEERING	729895-01001

FIGURE 4-7
SEAD-16 TOTAL CARCINOGENIC
PAHs IN SEDMENTS

SCALE	DATE	REV
1" = 100'	DECEMBER 1996	A



ACAD:SENECA\16-17RIF\SD16SMET.DWG

LEGEND

MINOR WATERWAY
MAJOR WATERWAY
FENCE
UNPAVED ROAD
BRUSH LINE
LANDFILL EXTENTS
RAILROAD
760 GROUND SURFACE ELEVATION CONTOUR

☒ SURVEY MONUMENT
ROAD SIGN
DECIDOUS TREE
FIRE HYDRANT
⊗ MANHOLE
△ GUIDE POST
⊙ POLE
UTILITY BOX
+ CORDINATE GRID (250' GRID)
OVERHEAD UTILITY POLE
MAILBOX/RR SIGNAL

L.D. LOADING DOCK

SEDIMENT SAMPLE LOCATION
SW/SD16-2

METAL	CONC.
LEAD	1250J
MERCURY	2J
ZINC	339J

CONCENTRATION IN mg/kg

50 0 50 100
1" = 100'

N

PARSONS
PARSONS ENGINEERING SCIENCE, INC.

CLIENT/PROJECT TITLE
SENECA ARMY DEPOT ACTIVITY
RI/FS
SEAD-16 ABANDONED DEACTIVATION FURNACE

DEPT ENVIRONMENTAL ENGINEERING
Dwg No. 729895-01001

FIGURE 4-8
SEAD-16 METALS IN SEDIMENT SAMPLES

SCALE 1" = 100'
DATE DECEMBER 1996
REV. A

4.1.7.7 Other Constituents

Nitrate/Nitrite-Nitrogen

Nitrate/nitrite-nitrogen was measured in the 11 sediment samples collected at SEAD-16. The concentrations ranged from 0.03 mg/kg to 0.67 mg/kg.

4.1.8 Summary of the Extent of Impacts at SEAD-16

On the basis of the analytical results obtained for the seven media at SEAD-16, the most significant impact to the site is from metals. Impacts from SVOCs and pesticides were also identified.

In the soil at SEAD-16, metals and SVOCs, predominantly PAH compounds, were found to be pervasive, particularly in the surface and subsurface soils adjacent to the Abandoned Deactivation Furnace. Of the 21 metals which exceeded their respective TAGM values, 14 metals were considered to be more toxic. Lead, copper, arsenic, and zinc were detected in almost all of the surface soil samples at concentrations above the respective TAGM values. On the basis of the surface soil data, the highest concentrations of metals were clearly located in the area between the Abandoned Deactivation Furnace Building (S-311) and the Process Support Building (366). In the subsurface soils, copper and lead were found to be most pervasive. The highest concentrations of PAH compounds in surface soils were detected in samples collected from locations adjacent to the northwestern corner of the Abandoned Deactivation Furnace Building. Nitroaromatic compounds were also present in the surface and subsurface soils near both buildings. Impacts from pesticides, PCBs, and herbicides in soil were less significant than the impacts from SVOCs and metals.

While it is likely that emissions of metals through the furnace stacks occurred at these sites, the spatial distribution of the highest concentrations of inorganics in surface soils suggests that some of the metals may be attributed to releases during handling of explosive waste; this is especially evident at SEAD-16 where the highest concentrations of inorganics were found between the furnace building (Building S-311) and the Process Support Building (Building 366).

In the groundwater, seven metals were detected above the respective NYS Class GA or federal MCL standards. Impacts from SVOCs and nitroaromatics were less significant. No VOCs, pesticides, or PCBs were detected in the groundwater at SEAD-16.

Generally, surface water impacts were from metals, six of which were found at concentrations that exceeded their standards at several locations. The metals included lead, copper, zinc, cadmium, selenium, and iron. Three of these metals (lead, copper and zinc) were also found to be widely distributed in surface soils on-site, and thus, surface soils are a likely source area for the metals found in the surface water samples. SVOCs were found in a few surface water samples, but only one was above the NYS Class C standard. Many of the other chemical constituents analyzed for were not present in the samples. No VOCs, pesticides, PCBs, or nitroaromatics were detected in the samples.

Sediment impacts were primarily from SVOCs and pesticides, which were pervasive. Several pesticide compounds exceeded their respective NYS sediment criteria and by far the most significant exceedences were in the sediment sample, SW/SD16-1, which was collected from the northeastern corner of the Abandoned Deactivation Furnace. Several metals were detected at concentrations above the NYS LEL with the highest concentrations found at SW/SD16-3 and SW/SD16-10. Impacts from nitroaromatics were less significant.

In the building material samples collected from the Abandoned Deactivation Furnace Building (S-311) and the Process Support Building (366), metals, SVOCs, and nitroaromatics were detected above their TAGM values. The metals antimony, copper, lead, and zinc were detected in all 12 of the building material samples at concentrations above their respective TAGM values. The SVOCs found were mostly PAHs, and among these benzo(a)pyrene was found at the highest concentration (1,500 µg/kg). The maximum concentration of total carcinogenic PAHs was 54,000 µg/kg, which was found in a propellant residue sample (BS-10). The highest concentrations of nitroaromatics were found in the vacuum system recovery vats in Building 366, where 2,4-dinitrotoluene was found at concentrations of 19,000,000 µg/kg and 3,700,000 µg/kg. Impacts from VOCs, pesticides, PCBs, and herbicides were less significant. Asbestos was detected at 13 locations in the two buildings in such materials as pipe insulation, roofing material, and floor tiles.

4.2 SEAD-17

4.2.1 Introduction

This section presents the analytical results for all media sampled at SEAD-17. Data from the ESI and the RI investigations have been merged into a single data base and they are discussed as a whole in this RI report.

The investigation activities performed for the RI generated Level I and Level IV analytical data. These data categories are described in the earlier DQO document (USEPA, 1987). The Interim Final Guidance (USEPA, 1993) describes two data categories, screening data with definitive confirmation, and definitive data. These two categories are associated with specific quality assurance and quality control elements. The Level I and IV data meet the applicable QA/QC requirements for screening and definitive data which are presented in the Interim Final Guidance. To maintain consistency between the workplans and reports prepared for SEDA, the data categories will continue to be referred to using "Level" terminology.

The Level I data was gathered primarily for health and safety reasons during soil boring and monitoring well sampling activities using field screening instruments, (such as a Thermoenvironmental, Inc. OVM 580B and a Miniram PDM-3 dust monitor). Level IV analyses were used to generate data that would positively identify constituents at SEAD-17 , and define the extent of their impacts in five types of media. The five types of media defined for SEAD-17 are as follows:

- Surface Soil;
- Subsurface Soil;
- Groundwater;
- Surface Water; and
- Sediment.

For each of theses media, the parameter groups analyzed for include: VOCs, SVOCs, pesticides and PCBs, nitroaromatics, metals, nitrate/nitrite-nitrogen, and herbicides (for ESI soil and groundwater samples only); the VOC and SVOC analyses also included the identification and estimation of tentatively identified compounds (TICs).

The Level IV analytical results are discussed first by media and then by constituent group. The analytical results are summarized on data tables and, where appropriate, maps are used to show the horizontal and vertical distribution of constituents of concern at the site. Complete analytical data tables are in Appendix G.

4.2.2 Soil

The discussion of soils is divided into surface soils and subsurface soils within each media. Surface soils are defined as those soils from 0 to 2 inches below the ground surface or organic matter. Subsurface soil occurs below 6 inches.

NYSDEC TAGM values were determined to be the most appropriate as a basis of comparison for the soil sample results. For metals, the TAGM is the value listed in NYSDEC Technical and Administrative Guidance Memorandum (TAGM) HWR-94-4046 (revised January 24, 1994), or the background concentration as determined from the SEDA-wide database of 57 background samples, whichever is higher.

Summary statistics for the surface soil , subsurface soil, and downwind soil analyses are shown in Tables 4-28, 4-29, and 4-30.

4.2.2.1 Volatile Organic Compounds

Surface Soils

A total of 38 surface soil samples were obtained at SEAD-17. (Table 4-31). Eleven additional surface soil samples were collected along the downwind transect between SEAD-16 and SEAD-17. These downwind samples will be discussed separately. Three of the four VOCs which were detected in the surface soil samples are not believed to be representative of the soil chemistry at the site. Namely, acetone, methylene chloride, and toluene, all of which are common laboratory contaminants, were detected at a low concentrations in several of the samples. Instead, these compounds are likely to be an artifact of the laboratory analysis procedures.

Benzene was detected in one sample SS17-29 at a concentration of 2 J μg/kg, which is far below the NYSDEC TAGM of 60 μg/kg.

All detection limits for the VOC compounds were below the respective TAGM values.

In addition to the NYSDEC TCL-listed VOCs, TICs were estimated for the surface soil samples (Table 4-32). The highest concentration of TICs in the surface soil samples is 983 μg/kg in sample SS17-19. The highest total VOC concentration (983 μg/kg) was also found at this location, which is comprised of TCL-listed compounds and TICs. This concentration is well below the NYSDEC TAGM criteria value of 10,000 μg/kg for total VOC.

Subsurface Soils

No VOCs were detected in the subsurface soils analyzed at SEAD-17 (Table 4-33).

In addition to the NYSDEC TCL-listed VOCs, TICs were estimated for the subsurface soil samples (Table 4-34). TICs were detected in only one sample, SB17-2, at a concentration of 7 μg/kg.

Table 4-28
SEAD-17 Summary Statistics for Surface Soil Samples

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
VOLATILE ORGANICS								
1,1,1-Trichloroethane	UG/KG	38	0	0%				
1,1,2,2-Tetrachloroethane	UG/KG	38	0	0%				
1,1,2-Trichloroethane	UG/KG	38	0	0%				
1,1-Dichloroethane	UG/KG	38	0	0%				
1,1-Dichloroethene	UG/KG	38	0	0%				
1,2-Dichloroethane	UG/KG	38	0	0%				
1,2-Dichloroethene (total)	UG/KG	38	0	0%				
1,2-Dichloropropane	UG/KG	38	0	0%				
2-Butanone	UG/KG	38	0	0%				
2-Hexanone	UG/KG	38	0	0%				
4-Methyl-2-Pentanone	UG/KG	38	0	0%				
Acetone	UG/KG	38	3	8%	7	15	10	4.359
Benzene	UG/KG	38	0	3%				
Bromodichloromethane	UG/KG	38	0	0%				
Bromoform	UG/KG	38	0	0%				
Bromomethane	UG/KG	38	0	0%				
Carbon Disulfide	UG/KG	38	0	0%				
Carbon Tetrachloride	UG/KG	38	0	0%				
Chlorobenzene	UG/KG	38	0	0%				
Chloroethane	UG/KG	38	0	0%				
Chloroform	UG/KG	38	0	0%				
Chloromethane	UG/KG	38	0	0%				
Dibromochloromethane	UG/KG	38	0	0%				
Ethylbenzene	UG/KG	38	0	0%				
Methylene Chloride	UG/KG	38	1	3%	4	4	4	0
Styrene	UG/KG	38	0	0%				
Tetrachloroethene	UG/KG	38	0	0%				
Toluene	UG/KG	38	3	8%	1	8	4.333	3.512
Trichloroethene	UG/KG	38	0	0%				
Vinyl Chloride	UG/KG	38	0	0%				
Xylene (total)	UG/KG	38	0	0%				
cis-1,3-Dichloropropene	UG/KG	38	0	0%				
trans-1,3-Dichloropropene	UG/KG	38	0	0%				
SEMIVOLATILE ORGANICS								
1,2,4-Trichlorobenzene	UG/KG	38	0	0%				
1,2-Dichlorobenzene	UG/KG	38	0	0%				
1,3-Dichlorobenzene	UG/KG	38	0	0%				
1,4-Dichlorobenzene	UG/KG	38	0	0%				
2,2'-oxybis(1-Chloropropane)	UG/KG	24	0	0%				

Table 4-28
SEAD-17 Summary Statistics for Surface Soil Samples

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
2,4,5-Trichlorophenol	UG/KG	38	0	0%				
2,4,6-Trichlorophenol	UG/KG	38	0	0%				
2,4-Dichlorophenol	UG/KG	38	0	0%				
2,4-Dimethylphenol	UG/KG	38	0	0%				
2,4-Dinitrophenol	UG/KG	38	0	0%				
2,4-Dinitrotoluene	UG/KG	38	4	10%	24	1400	392.5	672.135
2,6-Dinitrotoluene	UG/KG	38	1	3%	70	70	70	0
2-Chloronaphthalene	UG/KG	38	0	0%				
2-Chlorophenol	UG/KG	38	0	0%				
2-Methylnaphthalene	UG/KG	38	1	3%	130	130	130	0
2-Methylphenol	UG/KG	38	0	0%				
2-Nitroaniline	UG/KG	38	0	0%				
2-Nitrophenol	UG/KG	38	0	0%				
3,3'-Dichlorobenzidine	UG/KG	38	1	3%	410	410	410	0
3-Nitroaniline	UG/KG	38	1	3%	990	990	990	0
4,6-Dinitro-2-methylphenol	UG/KG	38	0	0%				
4-Bromophenyl-phenylether	UG/KG	38	0	0%				
4-Chloro-3-methylphenol	UG/KG	38	0	0%				
4-Chloroaniline	UG/KG	38	0	0%				
4-Chlorophenyl-phenylether	UG/KG	38	0	0%				
4-Methylphenol	UG/KG	38	0	0%				
4-Nitroaniline	UG/KG	38	1	3%	990	990	990	0
4-Nitrophenol	UG/KG	38	0	0%				
Acenaphthene	UG/KG	38	0	0%				
Acenaphthylene	UG/KG	38	0	0%				
Anthracene	UG/KG	38	1	3%	23	23	23	0
Benzo(a)anthracene	UG/KG	38	11	28%	16	72	29.818	15.842
Benzo(a)pyrene	UG/KG	38	11	29%	18	58	28.273	11.136
Benzo(b)fluoranthene	UG/KG	38	13	33%	17	70	37.385	16.939
Benzo(g,h,i)perylene	UG/KG	38	8	20%	22	82	42.375	20.653
Benzo(k)fluoranthene	UG/KG	38	10	25%	17	49	28	10.965
Butylbenzylphthalate	UG/KG	38	2	5%	37	46	41.5	6.364
Carbazole	UG/KG	38	1	3%	410	410	410	0
Chrysene	UG/KG	38	20	53%	18	78	33.85	18.782
Di-n-butylphthalate	UG/KG	38	19	48%	21	1200	275	318.909
Di-n-octylphthalate	UG/KG	38	0	0%				
Dibenz(a,h)anthracene	UG/KG	38	3	8%	40	59	51.333	10.017
Dibenzofuran	UG/KG	38	0	0%				
Diethylphthalate	UG/KG	38	0	0%				
Dimethylphthalate	UG/KG	38	0	0%				

Table 4-28

SEAD-17 Summary Statistics for Surface Soil Samples

SEAD-17 Remedial Investigation

Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
Fluoranthene	UG/KG	38	25	66%	19	190	47.481	41.037
Fluorene	UG/KG	38	0	0%				
Hexachlorobenzene	UG/KG	38	0	0%				
Hexachlorobutadiene	UG/KG	38	0	0%				
Hexachlorocyclopentadiene	UG/KG	38	0	0%				
Hexachloroethane	UG/KG	38	0	0%				
Indeno(1,2,3-cd)pyrene	UG/KG	38	5	13%	25	62	38	14.474
Isophorone	UG/KG	38	0	0%				
N-Nitroso-di-n-propylamine	UG/KG	38	0	0%				
N-Nitrosodiphenylamine (1)	UG/KG	38	2	5%	27	71	49	31.113
Naphthalene	UG/KG	38	1	3%	37	37	37	0
Nitrobenzene	UG/KG	38	0	0%				
Pentachlorophenol	UG/KG	38	2	5%	43	990	516.5	669.63
Phenanthrene	UG/KG	38	15	38%	18	120	39.467	27.417
Phenol	UG/KG	38	0	0%				
Pyrene	UG/KG	38	24	63%	17	170	48.25	33.106
bis(2-Chloroethoxy) methane	UG/KG	38	0	0%				
bis(2-Chloroethyl) ether	UG/KG	38	0	0%				
bis(2-Chloroisopropyl) ether	UG/KG	14	1	6%	410	410	410	0
bis(2-Ethylhexyl)phthalate	UG/KG	38	12	30%	50	1300	608.333	430.831
PESTICIDES/PCB								
4,4'-DDD	UG/KG	38	4	10%	1.7	15	6	6.13
4,4'-DDE	UG/KG	38	17	43%	2.2	37	11.876	10.483
4,4'-DDT	UG/KG	38	9	23%	1.9	16	7.389	5.075
Aldrin	UG/KG	38	1	3%	1.9	1.9	1.9	0
Aroclor-1016	UG/KG	38	0	0%				
Aroclor-1221	UG/KG	38	0	0%				
Aroclor-1232	UG/KG	38	0	0%				
Aroclor-1242	UG/KG	38	0	0%				
Aroclor-1248	UG/KG	38	0	0%				
Aroclor-1254	UG/KG	38	0	0%				
Aroclor-1260	UG/KG	38	3	8%	21	28	25.667	4.041
Dieldrin	UG/KG	38	6	15%	12	80	33.5	29.838
Endosulfan I	UG/KG	38	2	5%	0.76	2.4	1.58	1.16
Endosulfan II	UG/KG	38	0	0%				
Endosulfan sulfate	UG/KG	38	0	0%				
Endrin	UG/KG	38	1	3%	1.8	1.8	1.8	0
Endrin aldehyde	UG/KG	38	0	0%				
Endrin ketone	UG/KG	38	0	0%				
Heptachlor	UG/KG	38	0	0%				

Table 4-28
SEAD-17 Summary Statistics for Surface Soil Samples

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
Heptachlor epoxide	UG/KG	38	1	3%	1.1	1.1	1.1	0
Methoxychlor	UG/KG	38	0	0%				
Toxaphene	UG/KG	38	0	0%				
alpha-BHC	UG/KG	38	0	0%				
alpha-Chlordane	UG/KG	38	0	0%				
beta-BHC	UG/KG	38	0	0%				
delta-BHC	UG/KG	38	0	0%				
gamma-BHC (Lindane)	UG/KG	38	0	0%				
gamma-Chlordane	UG/KG	38	0	0%				
OTHER ANALYSES								
Nitrate/Nitrite-Nitrogen	MG/KG	38	38	100%	0.06	3.8	0.493	0.866
Percent Moisture (PEST/PCB)		14	14	100%	4	21	14.857	4.865
Percent Moisture (SVOCs)		14	14	100%	4	21	14.929	4.859
Percent Moisture (VOCs)		14	14	100%	3	25	16.286	5.581
Percent Solids (Metals)		14	14	100%	79.2	96.1	85.093	4.799
Total Organic Carbon	MG/KG	2	2	100%	32700	40900	36800	5798.276
NITROAROMATICS								
1,3,5-Trinitrobenzene	UG/KG	38	0	0%				
1,3-Dinitrobenzene	UG/KG	38	0	0%				
2,4,6-Trinitrotoluene	UG/KG	38	0	0%				
2,4-Dinitrotoluene	UG/KG	38	4	11%	72	330	175.5	110.579
2,6-Dinitrotoluene	UG/KG	38	0	0%				
2-amino-4,6-Dinitrotoluene	UG/KG	38	0	0%				
4-amino-2,6-Dinitrotoluene	UG/KG	38	0	0%				
HMX	UG/KG	38	0	0%				
Nitrobenzene	UG/KG	14	0	0%				
RDX	UG/KG	38	0	0%				
Tetryl	UG/KG	38	0	0%				
METALS								
Aluminum	MG/KG	38	38	100%	3790	18400	13370	3284.139
Antimony	MG/KG	38	18	47%	1.4	52	11.383	15.718
Arsenic	MG/KG	38	38	100%	4	16.1	6.408	2.27
Barium	MG/KG	38	22	50%	78.7	524	200.927	126.777
Beryllium	MG/KG	38	38	100%	0.18	0.87	0.589	0.168
Cadmium	MG/KG	38	33	87%	0.5	25.5	5.275	5.464
Calcium	MG/KG	38	38	100%	2180	209000	44053.95	58138.47
Chromium	MG/KG	38	38	100%	9.7	27.2	20.224	3.989
Cobalt	MG/KG	38	38	100%	4.7	21.9	10.061	3.127
Copper	MG/KG	38	38	100%	22.6	837	190.913	206.253
Cyanide	MG/KG	38	2	5%	0.78	1.5	1.14	0.509

Table 4-28
SEAD-17 Summary Statistics for Surface Soil Samples

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
Iron	MG/KG	38	38	100%	8020	28800	22384.74	480.896
Lead	MG/KG	38	37	97%	44.9	6270	1074.868	1271.889
Magnesium	MG/KG	38	38	100%	2540	17300	5718.684	2915.698
Manganese	MG/KG	38	38	100%	221	996	530.263	195.569
Mercury	MG/KG	38	37	97%	0.03	1	0.126	0.206
Nickel	MG/KG	38	38	100%	14.1	47.8	27.668	8.702
Potassium	MG/KG	38	38	100%	975	2260	1419.421	279.245
Selenium	MG/KG	38	26	68%	0.16	1.7	0.731	0.429
Silver	MG/KG	38	17	45%	0.45	9	2.981	2.39
Sodium	MG/KG	38	28	74%	33.5	249	118.968	68.974
Thallium	MG/KG	38	7	18%	0.22	1.5	1	0.441
Vanadium	MG/KG	38	38	100%	8.9	30.1	22.876	5.63
Zinc	MG/KG	38	38	100%	71.6	1530	365.405	381.41
HERBICIDES								
2,4,5-T	UG/KG	24	0	0%				
2,4,5-TP (Silvex)	UG/KG	24	0	0%				
2,4-D	UG/KG	24	0	0%				
2,4-DB	UG/KG	24	0	0%				
Dalapon	UG/KG	24	0	0%				
Dicamba	UG/KG	24	0	0%				
Dichloroprop	UG/KG	24	0	0%				
Dinoseb	UG/KG	24	0	0%				
MCPA	UG/KG	24	4	17%	12000	34000	23500	11120.55
MCPP	UG/KG	24	0	0%				

Table 4-29
SEAD-17 Summary Statistics for Subsurface Soil Samples

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
VOLATILE ORGANICS								
1,1,1-Trichloroethane	UG/KG	10	0	0%				
1,1,2,2-Tetrachloroethane	UG/KG	10	0	0%				
1,1,2-Trichloroethane	UG/KG	10	0	0%				
1,1-Dichloroethane	UG/KG	10	0	0%				
1,1-Dichloroethene	UG/KG	10	0	0%				
1,2-Dichloroethane	UG/KG	10	0	0%				
1,2-Dichloroethene (total)	UG/KG	10	0	0%				
1,2-Dichloropropane	UG/KG	10	0	0%				
2-Butanone	UG/KG	10	0	0%				
2-Hexanone	UG/KG	10	0	0%				
4-Methyl-2-Pentanone	UG/KG	10	0	0%				
Acetone	UG/KG	10	0	0%				
Benzene	UG/KG	10	0	0%				
Bromodichloromethane	UG/KG	10	0	0%				
Bromoform	UG/KG	10	0	0%				
Bromomethane	UG/KG	10	0	0%				
Carbon Disulfide	UG/KG	10	0	0%				
Carbon Tetrachloride	UG/KG	10	0	0%				
Chlorobenzene	UG/KG	10	0	0%				
Chloroethane	UG/KG	10	0	0%				
Chloroform	UG/KG	10	0	0%				
Chloromethane	UG/KG	10	0	0%				
Dibromochloromethane	UG/KG	10	0	0%				
Ethylbenzene	UG/KG	10	0	0%				
Methylene Chloride	UG/KG	10	0	0%				
Styrene	UG/KG	10	0	0%				
Tetrachloroethene	UG/KG	10	0	0%				
Toluene	UG/KG	10	0	0%				
Trichloroethene	UG/KG	10	0	0%				
Vinyl Chloride	UG/KG	10	0	0%				
Xylene (total)	UG/KG	10	0	0%				
cis-1,3-Dichloropropene	UG/KG	10	0	0%				
trans-1,3-Dichloropropene	UG/KG	10	0	0%				
SEMIVOLATILE ORGANICS								
1,2,4-Trichlorobenzene	UG/KG	10	0	0%				
1,2-Dichlorobenzene	UG/KG	10	0	0%				
1,3-Dichlorobenzene	UG/KG	10	0	0%				
1,4-Dichlorobenzene	UG/KG	10	0	0%				
2,2'-oxybis(1-Chloropropane)	UG/KG	10	0	0%				

Table 4-29
SEAD-17 Summary Statistics for Subsurface Soil Samples

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
2,4,5-Trichlorophenol	UG/KG	10	0	0%				
2,4,6-Trichlorophenol	UG/KG	10	0	0%				
2,4-Dichlorophenol	UG/KG	10	0	0%				
2,4-Dimethylphenol	UG/KG	10	0	0%				
2,4-Dinitrophenol	UG/KG	10	0	0%				
2,4-Dinitrotoluene	UG/KG	10	0	0%				
2,6-Dinitrotoluene	UG/KG	10	0	0%				
2-Chloronaphthalene	UG/KG	10	0	0%				
2-Chlorophenol	UG/KG	10	0	0%				
2-Methylnaphthalene	UG/KG	10	0	0%				
2-Methylphenol	UG/KG	10	0	0%				
2-Nitroaniline	UG/KG	10	0	0%				
2-Nitrophenol	UG/KG	10	0	0%				
3,3'-Dichlorobenzidine	UG/KG	10	0	0%				
3-Nitroaniline	UG/KG	10	0	0%				
4,6-Dinitro-2-methylphenol	UG/KG	10	0	0%				
4-Bromophenyl-phenylether	UG/KG	10	0	0%				
4-Chloro-3-methylphenol	UG/KG	10	0	0%				
4-Chloroaniline	UG/KG	10	0	0%				
4-Chlorophenyl-phenylether	UG/KG	10	0	0%				
4-Methylphenol	UG/KG	10	0	0%				
4-Nitroaniline	UG/KG	10	0	0%				
4-Nitrophenol	UG/KG	10	0	0%				
Acenaphthene	UG/KG	10	0	0%				
Acenaphthylene	UG/KG	10	0	0%				
Anthracene	UG/KG	10	0	0%				
Benzo(a)anthracene	UG/KG	10	0	0%				
Benzo(a)pyrene	UG/KG	10	0	0%				
Benzo(b)fluoranthene	UG/KG	10	0	0%				
Benzo(g,h,i)perylene	UG/KG	10	0	0%				
Benzo(k)fluoranthene	UG/KG	10	0	0%				
Butylbenzylphthalate	UG/KG	10	0	0%				
Carbazole	UG/KG	10	0	0%				
Chrysene	UG/KG	10	0	0%				
Di-n-butylphthalate	UG/KG	10	0	0%				
Di-n-octylphthalate	UG/KG	10	0	0%				
Dibenz(a,h)anthracene	UG/KG	10	0	0%				
Dibenzofuran	UG/KG	10	0	0%				
Diethylphthalate	UG/KG	10	0	0%				
Dimethylphthalate	UG/KG	10	0	0%				

Table 4-29
SEAD-17 Summary Statistics for Subsurface Soil Samples

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
Fluoranthene	UG/KG	10	0	0%				
Fluorene	UG/KG	10	0	0%				
Hexachlorobenzene	UG/KG	10	0	0%				
Hexachlorobutadiene	UG/KG	10	0	0%				
Hexachlorocyclopentadiene	UG/KG	10	0	0%				
Hexachloroethane	UG/KG	10	0	0%				
Indeno(1,2,3-cd)pyrene	UG/KG	10	0	0%				
Isophorone	UG/KG	10	0	0%				
N-Nitroso-di-n-propylamine	UG/KG	10	0	0%				
N-Nitrosodiphenylamine (1)	UG/KG	10	0	0%				
Naphthalene	UG/KG	10	0	0%				
Nitrobenzene	UG/KG	10	0	0%				
Pentachlorophenol	UG/KG	10	0	0%				
Phenanthrene	UG/KG	10	0	0%				
Phenol	UG/KG	10	0	0%				
Pyrene	UG/KG	10	0	0%				
bis(2-Chloroethoxy) methane	UG/KG	10	0	0%				
bis(2-Chloroethyl) ether	UG/KG	10	0	0%				
bis(2-Ethylhexyl)phthalate	UG/KG	10	8	80%	21	490	160.5	201.66
PESTICIDES/PCB								
4,4'-DDD	UG/KG	10	0	0%				
4,4'-DDE	UG/KG	10	0	0%				
4,4'-DDT	UG/KG	10	0	0%				
Aldrin	UG/KG	10	0	0%				
Aroclor-1016	UG/KG	10	0	0%				
Aroclor-1221	UG/KG	10	0	0%				
Aroclor-1232	UG/KG	10	0	0%				
Aroclor-1242	UG/KG	10	0	0%				
Aroclor-1248	UG/KG	10	0	0%				
Aroclor-1254	UG/KG	10	1	10%	61	61	61	0
Aroclor-1260	UG/KG	10	0	0%				
Dieldrin	UG/KG	10	0	0%				
Endosulfan I	UG/KG	10	0	0%				
Endosulfan II	UG/KG	10	0	0%				
Endosulfan sulfate	UG/KG	10	0	0%				
Endrin	UG/KG	10	0	0%				
Endrin aldehyde	UG/KG	10	0	0%				
Endrin ketone	UG/KG	10	0	0%				
Heptachlor	UG/KG	10	0	0%				
Heptachlor epoxide	UG/KG	10	0	0%				

Table 4-29
SEAD-17 Summary Statistics for Subsurface Soil Samples

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
Methoxychlor	UG/KG	10	0	0%				
Toxaphene	UG/KG	10	0	0%				
alpha-BHC	UG/KG	10	0	0%				
alpha-Chlordane	UG/KG	10	0	0%				
beta-BHC	UG/KG	10	0	0%				
delta-BHC	UG/KG	10	0	0%				
gamma-BHC (Lindane)	UG/KG	10	0	0%				
gamma-Chlordane	UG/KG	10	0	0%				
OTHER ANALYSES								
Nitrate/Nitrite-Nitrogen	MG/KG	10	9	90%	0.05	0.51	0.258	0.139
NITROAROMATICS								
1,3,5-Trinitrobenzene	UG/KG	10	0	0%				
1,3-Dinitrobenzene	UG/KG	10	0	0%				
2,4,6-Trinitrotoluene	UG/KG	10	0	0%				
2,4-Dinitrotoluene	UG/KG	10	0	0%				
2,6-Dinitrotoluene	UG/KG	10	0	0%				
2-amino-4,6-Dinitrotoluene	UG/KG	10	0	0%				
4-amino-2,6-Dinitrotoluene	UG/KG	10	0	0%				
HMX	UG/KG	10	0	0%				
RDX	UG/KG	10	0	0%				
Tetryl	UG/KG	10	0	0%				
METALS								
Aluminum	MG/KG	10	10	100%	8700	19300	14530	3056.16
Antimony	MG/KG	10	0	0%				
Arsenic	MG/KG	10	10	100%	3.4	6.9	5.14	1.038
Barium	MG/KG	10	10	100%	51.6	158	89.68	31.919
Beryllium	MG/KG	10	10	100%	0.42	0.99	0.668	0.169
Cadmium	MG/KG	10	1	10%	2.8	2.8	2.8	0
Calcium	MG/KG	10	10	100%	2620	115000	33325	37287.38
Chromium	MG/KG	10	10	100%	13.9	27.9	21.53	4.403
Cobalt	MG/KG	10	10	100%	8.8	21.7	11.3	3.884
Copper	MG/KG	10	10	100%	18.5	85.1	31.79	20.283
Cyanide	MG/KG	10	0	0%				
Iron	MG/KG	10	10	100%	18800	38700	27930	5760.989
Lead	MG/KG	10	10	100%	7.5	686	106.46	218.538
Magnesium	MG/KG	10	10	100%	3330	18100	7678	4075.861
Manganese	MG/KG	10	10	100%	274	1160	576.2	307.884
Mercury	MG/KG	10	7	70%	0.03	0.06	0.046	0.011
Nickel	MG/KG	10	10	100%	19.1	42	30.73	6.383
Potassium	MG/KG	10	10	100%	628	1750	1344.8	367.138

Table 4-29
SEAD-17 Summary Statistics for Subsurface Soil Samples

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
Selenium	MG/KG	10	0	0%				
Silver	MG/KG	10	0	0%				
Sodium	MG/KG	10	10	100%	46.2	239	111.13	61.422
Thallium	MG/KG	10	0	0%				
Vanadium	MG/KG	10	10	100%	13.9	30.7	23.35	4.833
Zinc	MG/KG	10	10	100%	57.1	172	83.04	33.13
HERBICIDES								
2,4,5-T	UG/KG	10	0	0%				
2,4,5-TP (Silvex)	UG/KG	10	0	0%				
2,4-D	UG/KG	10	0	0%				
2,4-DB	UG/KG	10	0	0%				
Dalapon	UG/KG	10	0	0%				
Dicamba	UG/KG	10	0	0%				
Dichloroprop	UG/KG	10	0	0%				
Dinoseb	UG/KG	10	0	0%				
MCPA	UG/KG	10	0	0%				
MCPP	UG/KG	10	0	0%				

Table 4-30
Summary Statististics for Downwind Samples

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
VOLATILE ORGANICS								
1,1,1-Trichloroethane	UG/KG	9	0	0%				
1,1,2,2-Tetrachloroethane	UG/KG	9	0	0%				
1,1,2-Trichloroethane	UG/KG	9	0	0%				
1,1-Dichloroethane	UG/KG	9	0	0%				
1,1-Dichloroethene	UG/KG	9	0	0%				
1,2-Dichloroethane	UG/KG	9	0	0%				
1,2-Dichloroethene (total)	UG/KG	9	0	0%				
1,2-Dichloropropane	UG/KG	9	0	0%				
2-Butanone	UG/KG	9	0	0%				
2-Hexanone	UG/KG	9	0	0%				
4-Methyl-2-Pentanone	UG/KG	9	0	0%				
Acetone	UG/KG	9	0	0%				
Benzene	UG/KG	9	1	11%	2	2	2	0
Bromodichloromethane	UG/KG	9	0	0%				
Bromoform	UG/KG	9	0	0%				
Bromomethane	UG/KG	9	0	0%				
Carbon Disulfide	UG/KG	9	0	0%				
Carbon Tetrachloride	UG/KG	9	0	0%				
Chlorobenzene	UG/KG	9	0	0%				
Chloroethane	UG/KG	9	0	0%				
Chloroform	UG/KG	9	0	0%				
Chloromethane	UG/KG	9	0	0%				
Dibromochloromethane	UG/KG	9	0	0%				
Ethylbenzene	UG/KG	9	0	0%				
Methylene Chloride	UG/KG	9	0	0%				
Styrene	UG/KG	9	0	0%				
Tetrachloroethene	UG/KG	9	0	0%				
Toluene	UG/KG	9	2	22%	2	3	2.5	0.707
Trichloroethene	UG/KG	9	0	0%				
Vinyl Chloride	UG/KG	9	0	0%				
Xylene (total)	UG/KG	9	0	0%				
cis-1,3-Dichloropropene	UG/KG	9	0	0%				
trans-1,3-Dichloropropene	UG/KG	9	0	0%				
SEMIVOLATILE ORGANICS								
1,2,4-Trichlorobenzene	UG/KG	9	0	0%				
1,2-Dichlorobenzene	UG/KG	9	0	0%				
1,3-Dichlorobenzene	UG/KG	9	0	0%				
1,4-Dichlorobenzene	UG/KG	9	0	0%				

Table 4-30
Summary Statistics for Downwind Samples

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
2,4,5-Trichlorophenol	UG/KG	9	0	0%				
2,4,6-Trichlorophenol	UG/KG	9	0	0%				
2,4-Dichlorophenol	UG/KG	9	0	0%				
2,4-Dimethylphenol	UG/KG	9	0	0%				
2,4-Dinitrophenol	UG/KG	9	0	0%				
2,4-Dinitrotoluene	UG/KG	9	2	22%	400	880	640	339.411
2,6-Dinitrotoluene	UG/KG	9	0	0%				
2-Chloronaphthalene	UG/KG	9	0	0%				
2-Chlorophenol	UG/KG	9	0	0%				
2-Methylnaphthalene	UG/KG	9	1	11%	28	28	28	0
2-Methylphenol	UG/KG	9	1	11%	120	120	120	0
2-Nitroaniline	UG/KG	9	0	0%				
2-Nitrophenol	UG/KG	9	0	0%				
3,3'-Dichlorobenzidine	UG/KG	9	0	0%				
3-Nitroaniline	UG/KG	9	0	0%				
4,6-Dinitro-2-methylphenol	UG/KG	9	0	0%				
4-Bromophenyl-phenylether	UG/KG	9	0	0%				
4-Chloro-3-methylphenol	UG/KG	9	0	0%				
4-Chloroaniline	UG/KG	9	0	0%				
4-Chlorophenyl-phenylether	UG/KG	9	0	0%				
4-Methylphenol	UG/KG	9	0	0%				
4-Nitroaniline	UG/KG	9	0	0%				
4-Nitrophenol	UG/KG	9	0	0%				
Acenaphthene	UG/KG	9	2	22%	18	33	25.5	10.607
Acenaphthylene	UG/KG	9	2	22%	35	96	65.5	43.134
Anthracene	UG/KG	9	2	22%	110	130	120	14.142
Benzo(a)anthracene	UG/KG	9	8	89%	19	720	188.25	262.752
Benzo(a)pyrene	UG/KG	9	8	89%	22	940	244.375	347.128
Benzo(b)fluoranthene	UG/KG	9	7	78%	42	2200	446	796.979
Benzo(g,h,i)perylene	UG/KG	9	8	89%	35	710	208	262.855
Benzo(k)fluoranthene	UG/KG	9	7	78%	38	530	129.714	177.428
Butylbenzylphthalate	UG/KG	9	0	0%				
Carbazole	UG/KG	9	2	22%	40	85	62.5	31.82
Chrysene	UG/KG	9	8	89%	25	670	197.625	249.603
Di-n-butylphthalate	UG/KG	9	1	11%	90	90	90	0
Di-n-octylphthalate	UG/KG	9	0	0%				
Dibenz(a,h)anthracene	UG/KG	9	7	78%	18	470	120.714	166.189
Dibenzofuran	UG/KG	9	1	11%	36	36	36	0
Diethylphthalate	UG/KG	9	0	0%				

Table 4-30
Summary Statististics for Downwind Samples

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
Dimethylphthalate	UG/KG	9	0	0%				
Fluoranthene	UG/KG	9	8	89%	36	1000	293.625	374.399
Fluorene	UG/KG	9	1	11%	38	38	38	0
Hexachlorobenzene	UG/KG	9	0	0%				
Hexachlorobutadiene	UG/KG	9	0	0%				
Hexachlorocyclopentadiene	UG/KG	9	0	0%				
Hexachloroethane	UG/KG	9	0	0%				
Indeno(1,2,3-cd)pyrene	UG/KG	9	8	89%	20	790	205.875	287.694
Isophorone	UG/KG	9	0	0%				
N-Nitroso-di-n-propylamine	UG/KG	9	0	0%				
N-Nitrosodiphenylamine (1)	UG/KG	9	2	22%	47	95	71	33.941
Naphthalene	UG/KG	9	2	22%	16	29	22.5	9.192
Nitrobenzene	UG/KG	9	0	0%				
Pentachlorophenol	UG/KG	9	0	0%				
Phenanthrene	UG/KG	9	7	78%	34	360	131	144.576
Phenol	UG/KG	9	0	0%				
Pyrene	UG/KG	9	8	89%	38	1200	294.625	411.602
bis(2-Chloroethoxy) methane	UG/KG	9	0	0%				
bis(2-Chloroethyl) ether	UG/KG	9	0	0%				
bis(2-Chloroisopropyl) ether	UG/KG	9	0	0%				
bis(2-Ethylhexyl)phthalate	UG/KG	9	0	0%				
PESTICIDES/PCB								
4,4'-DDD	UG/KG	9	0	0%				
4,4'-DDE	UG/KG	9	4	44%	1.9	140	39	67.394
4,4'-DDT	UG/KG	9	2	22%	6	13	9.5	4.95
Aldrin	UG/KG	9	0	0%				
Aroclor-1016	UG/KG	9	0	0%				
Aroclor-1221	UG/KG	9	0	0%				
Aroclor-1232	UG/KG	9	0	0%				
Aroclor-1242	UG/KG	9	0	0%				
Aroclor-1248	UG/KG	9	0	0%				
Aroclor-1254	UG/KG	9	0	0%				
Aroclor-1260	UG/KG	9	0	0%				
Dieldrin	UG/KG	9	1	11%	8.4	8.4	8.4	0
Endosulfan I	UG/KG	9	3	33%	1.6	430	147.867	244.39
Endosulfan II	UG/KG	9	0	0%				
Endosulfan sulfate	UG/KG	9	1	11%	20	20	20	0
Endrin	UG/KG	9	2	22%	5.6	43	24.3	26.446
Endrin aldehyde	UG/KG	9	0	0%				

Table 4-30
Summary Statististics for Downwind Samples

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
Endrin ketone	UG/KG	9	2	22%	4.8	71	37.9	46.81
Heptachlor	UG/KG	9	0	0%				
Heptachlor epoxide	UG/KG	9	0	0%				
Methoxychlor	UG/KG	9	0	0%				
Toxaphene	UG/KG	9	0	0%				
alpha-BHC	UG/KG	9	0	0%				
alpha-Chlordane	UG/KG	9	1	11%	1.1	1.1	1.1	0
beta-BHC	UG/KG	9	1	11%	20	20	20	0
delta-BHC	UG/KG	9	1	11%	2.2	2.2	2.2	0
gamma-BHC (Lindane)	UG/KG	9	0	0%				
gamma-Chlordane	UG/KG	9	0	0%				
OTHER ANALYSES								
Nitrate/Nitrite-Nitrogen	MG/KG	9	9	100%	0.06	6.1	1.607	2.524
Percent Moisture (PEST/PCB)		9	9	100%	3	19	12.333	5.074
Percent Moisture (SVOCs)		9	9	100%	3	19	12.333	5.074
Percent Moisture (VOCs)		9	9	100%	3	20	13.222	5.472
Percent Solids (Metals)		9	9	100%	81.4	97.2	87.533	5.096
NITROAROMATICS								
1,3,5-Trinitrobenzene	UG/KG	9	0	0%				
1,3-Dinitrobenzene	UG/KG	9	0	0%				
2,4,6-Trinitrotoluene	UG/KG	9	0	0%				
2,4-Dinitrotoluene	UG/KG	9	0	0%				
2,6-Dinitrotoluene	UG/KG	9	1	11%	900	900	900	0
2-amino-4,6-Dinitrotoluene	UG/KG	9	0	0%				
4-amino-2,6-Dinitrotoluene	UG/KG	9	0	0%				
HMX	UG/KG	9	0	0%				
Nitrobenzene	UG/KG	9	0	0%				
RDX	UG/KG	9	0	0%				
Tetryl	UG/KG	9	0	0%				
METALS								
Aluminum	MG/KG	9	9	100%	4120	14100	11115.56	3072.634
Antimony	MG/KG	9	6	67%	0.36	0.8	0.643	0.16
Arsenic	MG/KG	9	9	100%	3.8	5.6	4.733	0.512
Barium	MG/KG	9	9	100%	27.2	129	89.389	29.462
Beryllium	MG/KG	9	9	100%	0.16	0.57	0.429	0.126
Cadmium	MG/KG	9	9	100%	0.07	0.34	0.208	0.088
Calcium	MG/KG	9	9	100%	3410	229000	44397.78	76597.22
Chromium	MG/KG	9	9	100%	9.3	24.4	17.067	4.353
Cobalt	MG/KG	9	9	100%	4.7	15.7	9.333	3.346

Table 4-30
Summary Statististics for Downwind Samples

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
Copper	MG/KG	9	9	100%	14.9	39	23.278	7.689
Cyanide	MG/KG	9	0	0%				
Iron	MG/KG	9	9	100%	9760	29300	20895.56	5729.413
Lead	MG/KG	9	9	100%	16.7	58	31.878	15.107
Magnesium	MG/KG	9	9	100%	3200	8430	5401.111	1751.288
Manganese	MG/KG	9	9	100%	286	704	541	138.605
Mercury	MG/KG	9	8	89%	0.05	0.56	0.125	0.176
Nickel	MG/KG	9	9	100%	15.8	50.8	25.756	11.386
Potassium	MG/KG	9	9	100%	848	1730	1264.222	274.017
Selenium	MG/KG	9	9	100%	0.5	1.5	1.171	0.332
Silver	MG/KG	9	0	0%				
Sodium	MG/KG	9	4	44%	49.4	383	146.1	158.536
Thallium	MG/KG	9	3	33%	0.83	1.2	1.01	0.185
Vanadium	MG/KG	9	9	100%	15.5	22.3	19.456	1.795
Zinc	MG/KG	9	9	100%	53.2	109	77.989	20.701

Table 4-31
SEAD-17 Summary of Analytes Detected in Surface Soil

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS17-1		SS17-10		SS17-11		SS17-12		SS17-13		SS17-14	
			SAMP ID:	SS17-1-1		SS17-10-1		SS17-11-1		SS17-12-1		SS17-13-1		SS17-14-1	
			QC CODE:	SA		SA		SA		SA		SA		SA	
			STUDY ID:	ESI		ESI		ESI		ESI		ESI		ESI	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	10/21/93		11/9/93		11/9/93		10/21/93		10/20/93		10/21/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
VOLATILE ORGANICS															
Acetone	200	NYSDEC TAGM	UG/KG	12	U	11	U	13	U	12	U	7	J	11	U
Benzene	60	NYSDEC TAGM	UG/KG	12	U	11	U	13	U	12	U	11	U	11	U
Methylene Chloride	100	NYSDEC TAGM	UG/KG	12	U	11	U	13	U	12	U	4	J	11	U
Toluene	1500	NYSDEC TAGM	UG/KG	12	U	11	U	13	U	12	U	1	J	11	U
SEMIVOLATILE ORGANICS															
2,4-Dinitrotoluene			UG/KG	420	U	61	J	420	U	390	U	350	U	350	UJ
2,6-Dinitrotoluene	1000	NYSDEC TAGM	UG/KG	420	U	350	U	420	U	390	U	350	U	350	UJ
2-Methylnaphthalene	36400	NYSDEC TAGM	UG/KG	420	U	350	U	420	U	390	U	350	U	350	UJ
3,3'-Dichlorobenzidine			UG/KG	420	U	350	U	420	U	390	U	350	U	350	UJ
3-Nitroaniline	500	NYSDEC TAGM	UG/KG	1000	U	850	U	1000	U	940	U	860	U	850	UJ
4-Nitroaniline			UG/KG	1000	U	850	U	1000	U	940	U	860	U	850	UJ
Anthracene	50000	NYSDEC TAGM	UG/KG	23	J	350	U	420	U	390	U	350	U	350	UJ
Benzo(a)anthracene	224	NYSDEC TAGM	UG/KG	72	J	38	J	420	U	390	U	350	U	350	UJ
Benzo(a)pyrene	61	NYSDEC TAGM	UG/KG	58	J	32	J	420	U	390	U	350	U	350	UJ
Benzo(b)fluoranthene	1100	NYSDEC TAGM	UG/KG	70	J	50	J	420	U	390	U	350	U	350	UJ
Benzo(g,h,i)perylene	50000	NYSDEC TAGM	UG/KG	63	J	27	J	420	U	390	U	350	U	350	UJ
Benzo(k)fluoranthene	1100	NYSDEC TAGM	UG/KG	49	J	38	J	420	U	390	U	350	U	350	UJ
Butylbenzylphthalate	50000	NYSDEC TAGM	UG/KG	420	U	46	J	420	U	390	U	350	U	350	UJ
Carbazole			UG/KG	420	U	350	U	420	U	390	U	350	U	350	UJ
Chrysene	400	NYSDEC TAGM	UG/KG	75	J	78	J	420	U	390	U	350	U	350	UJ
Di-n-butylphthalate	8100	NYSDEC TAGM	UG/KG	51	J	48	J	66	J	210	J	21	J	350	UJ
Dibenz(a,h)anthracene	14	NYSDEC TAGM	UG/KG	**40**	**J**	350	U	420	U	390	U	350	U	350	UJ
Fluoranthene	50000	NYSDEC TAGM	UG/KG	190	J	150	J	420	U	390	U	19	J	350	UJ
Indeno(1,2,3-cd)pyrene	3200	NYSDEC TAGM	UG/KG	62	J	25	J	420	U	390	U	350	U	350	UJ

Note: Shaded values exceed the NYSDEC TAGM.
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T 4-31
SEAD-17 Summary of Analytes Detected in Surface Soil

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS17-1		SS17-10		SS17-11		SS17-12		SS17-13		SS17-14	
			SAMP ID:	SS17-1-1		SS17-10-1		SS17-11-1		SS17-12-1		SS17-13-1		SS17-14-1	
			QC CODE:	SA		SA		SA		SA		SA		SA	
			STUDY ID:	ESI		ESI		ESI		ESI		ESI		ESI	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	10/21/93		11/9/93		11/9/93		10/21/93		10/20/93		10/21/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
N-Nitrosodiphenylamine (1)			UG/KG	420	U	350	U	420	U	390	U	350	U	350	UJ
Naphthalene	13000	NYSDEC TAGM	UG/KG	420	U	350	U	420	U	390	U	350	U	350	UJ
Pentachlorophenol	1000	NYSDEC TAGM	UG/KG	1000	U	850	U	1000	U	940	U	860	U	850	UJ
Phenanthrene	50000	NYSDEC TAGM	UG/KG	120	J	72	J	420	U	390	U	19	J	350	UJ
Pyrene	50000	NYSDEC TAGM	UG/KG	170	J	110	J	26	J	390	U	17	J	350	UJ
bis(2-Chloroisopropyl) ether			UG/KG												
bis(2-Ethylhexyl)phthalate	50000	NYSDEC TAGM	UG/KG	530		810	U	1300		390	U	460	J	50	J
PESTICIDES/PCB															
4,4'-DDD	2900	NYSDEC TAGM	UG/KG	4.7	J	3.5	U	4.2	U	3.9	U	3.5	UJ	3.5	U
4,4'-DDE	2100	NYSDEC TAGM	UG/KG	5.2		37		4.2	U	2.9	J	11	J	2.7	J
4,4'-DDT	2100	NYSDEC TAGM	UG/KG	4.1	U	10		4.2	U	3.9	U	4.9	J	3.5	U
Aldrin	41	NYSDEC TAGM	UG/KG	2.1	U	1.8	U	2.2	U	2	U	1.8	UJ	1.8	U
Aroclor-1260	1000	NYSDEC TAGM	UG/KG	41	U	35	U	42	U	39	U	35	UJ	35	U
Dieldrin	44	NYSDEC TAGM	UG/KG	4.1	U	3.5	U	**62**		3.9	U	3.5	UJ	3.5	U
Endosulfan I	900	NYSDEC TAGM	UG/KG	2.1	U	1.8	U	2.2	U	2	U	0.76	J	1.8	U
Endrin	100	NYSDEC TAGM	UG/KG	4.1	U	3.5	U	4.2	U	3.9	U	3.5	UJ	3.5	U
Heptachlor epoxide	20	NYSDEC TAGM	UG/KG	2.1	U	1.8	U	2.2	U	2	U	1.8	UJ	1.8	U
OTHER ANALYSES															
Nitrate/Nitrite-Nitrogen			MG/KG	0.21		0.1		2.4		0.06		0.81		1.1	
Percent Moisture (PEST/PCB)															
Percent Moisture (SVOCs)															
Percent Moisture (VOCs)															
Percent Solids (Metals)															
Total Organic Carbon			MG/KG												
NITROAROMATICS															

Note: Shaded values exceed the NYSDEC TAGM.
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Ta. 4-31
SEAD-17 Summary of Analytes Detected in Surface Soil

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS17-1		SS17-10		SS17-11		SS17-12		SS17-13		SS17-14	
			SAMP ID:	SS17-1-1		SS17-10-1		SS17-11-1		SS17-12-1		SS17-13-1		SS17-14-1	
			QC CODE:	SA		SA		SA		SA		SA		SA	
			STUDY ID:	ESI		ESI		ESI		ESI		ESI		ESI	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	10/21/93		11/9/93		11/9/93		10/21/93		10/20/93		10/21/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
2,4-Dinitrotoluene			UG/KG	130	U	330	J	130	U	130	U	130		130	U
METALS															
Aluminum	14592.8	NYSDEC TAGM	MG/KG	11800		9990	J	14200		13100		10700		4660	
Antimony	3.59	NYSDEC TAGM	MG/KG	12.9	UR	**52**	**J**	12.4	U	10.8	UR	**39.2**		11.4	JR
Arsenic	7.5	NYSDEC TAGM	MG/KG	6		7	J	4.5	J	6.5		6.7		**10.6**	
Barium	300	NYSDEC TAGM	MG/KG	102	R	**357**	**J**	189		203	R	**343**		199	R
Beryllium	0.73	NYSDEC TAGM	MG/KG	0.5	J	0.48	J	**0.73**	**J**	0.59	J	0.5	J	0.34	J
Cadmium	1	NYSDEC TAGM	MG/KG	**2.3**		21.7	R	1.2	R	**4.5**		**8.3**		**10.8**	
Calcium	101904	NYSDEC TAGM	MG/KG	99300		**113000**	**J**	4670		88400		**104000**		**209000**	
Chromium	22.13	NYSDEC TAGM	MG/KG	16.6		21.3	J	19.7		20		**23.8**		9.8	
Cobalt	30	NYSDEC TAGM	MG/KG	6.1	J	9.9	J	9.3	J	12.3		8	J	5.6	J
Copper	25	NYSDEC TAGM	MG/KG	**81**		**546**	**J**	**60.7**	**J**	**202**		**404**		**499**	
Cyanide	0.3	NYSDEC TAGM	MG/KG	0.74	U	0.51	UJ	0.6	U	0.56	U	0.62	U	0.53	U
Iron	26626.7	NYSDEC TAGM	MG/KG	16400		21600	J	23100		23600		19500		11100	
Lead	21.86	NYSDEC TAGM	MG/KG	**594**		6340	R	**329**		**1210**		**2940**		**1310**	
Magnesium	12221.8	NYSDEC TAGM	MG/KG	7430		9830	J	3640		6600		8890		8330	
Manganese	669.38	NYSDEC TAGM	MG/KG	430		392	J	**685**		595		314	J	221	
Mercury	0.1	NYSDEC TAGM	MG/KG	0.07	J	0.03	UJ	0.07	J	0.07	J	0.03	J	**0.1**	**J**
Nickel	33.62	NYSDEC TAGM	MG/KG	19.8		**34.6**	**J**	21.3		**33.9**		31.9		28.5	
Potassium	1761.48	NYSDEC TAGM	MG/KG	1500		1350	J	1210		1260		1610		1370	
Selenium	2	NYSDEC TAGM	MG/KG	0.26	J	1.6	J	0.64	J	0.23	UJ	0.47	J	0.34	J
Silver	0.4	NYSDEC TAGM	MG/KG	1.6	UJ	**4.6**	**J**	1.6	UJ	1.4	UJ	**5.2**		**3.8**	**J**
Sodium	103.74	NYSDEC TAGM	MG/KG	**147**	**J**	**197**	**J**	49.8	J	**121**	**J**	**249**	**J**	**179**	**J**
Thallium	0.28	NYSDEC TAGM	MG/KG	0.24	U	0.22	UJ	0.22	UJ	0.25	U	0.21	U	1.3	U
Vanadium	150	NYSDEC TAGM	MG/KG	21		15.3	J	25.9		20		17.7		10.2	J

Note: **Shaded values exceed the** NYSDEC TAGM.
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Table 4-31
SEAD-17 Summary of Analytes Detected in Surface Soil

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS17-1		SS17-10		SS17-11		SS17-12		SS17-13		SS17-14	
			SAMP ID:	SS17-1-1		SS17-10-1		SS17-11-1		SS17-12-1		SS17-13-1		SS17-14-1	
			QC CODE:	SA		SA		SA		SA		SA		SA	
			STUDY ID:	ESI		ESI		ESI		ESI		ESI		ESI	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	10/21/93		11/9/93		11/9/93		10/21/93		10/20/93		10/21/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Zinc	82.5	NYSDEC TAGM	MG/KG	**200**		**620**	**J**	**110**	**J**	**574**		**315**		**480**	
HERBICIDES															
MCPA			UG/KG	16000		5300	U	6300	U	5900	U	5400	U	5300	U

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-31
SEAD-17 Summary of Analytes Detected in Surface Soil

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS17-15		SS17-16		SS17-17		SS17-18		SS17-18		SS17-19	
			SAMP ID:	SS17-15-1		SS17-16-1		SS17-17-1		SS17-18-1		SS17-24-1		SS17-19-1	
			QC CODE:	SA		SA		SA		SA		DU		SA	
			STUDY ID:	ESI		ESI		ESI		ESI		ESI		ESI	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	10/20/93		10/21/93		10/21/93		10/22/93		10/22/93		10/21/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
VOLATILE ORGANICS															
Acetone	200	NYSDEC TAGM	UG/KG	11	UR	13	U	72	U	13	U	15	J	41	U
Benzene	60	NYSDEC TAGM	UG/KG	11	UR	13	U	14	U	13	U	13	UJ	16	U
Methylene Chloride	100	NYSDEC TAGM	UG/KG	11	UR	13	U	14	U	13	U	13	UJ	16	U
Toluene	1500	NYSDEC TAGM	UG/KG	11	UR	13	U	14	U	13	U	13	UJ	16	U
SEMIVOLATILE ORGANICS															
2,4-Dinitrotoluene			UG/KG	350	UR	450	U	430	U	24	J	430	U	2300	U
2,6-Dinitrotoluene	1000	NYSDEC TAGM	UG/KG	350	UR	450	U	430	U	430	U	430	U	2300	U
2-Methylnaphthalene	36400	NYSDEC TAGM	UG/KG	350	UR	450	U	430	U	430	U	430	U	2300	U
3,3'-Dichlorobenzidine			UG/KG	350	UR	450	U	430	U	430	U	430	U	2300	U
3-Nitroaniline	500	NYSDEC TAGM	UG/KG	850	UR	1100	U	1100	U	1100	U	1000	U	5500	U
4-Nitroaniline			UG/KG	850	UR	1100	U	1100	U	1100	U	1000	U	5500	U
Anthracene	50000	NYSDEC TAGM	UG/KG	350	UR	450	U	430	U	430	U	430	U	2300	U
Benzo(a)anthracene	224	NYSDEC TAGM	UG/KG	350	UR	450	U	430	U	31	J	430	U	2300	U
Benzo(a)pyrene	61	NYSDEC TAGM	UG/KG	350	UR	450	U	430	U	31	J	430	U	2300	U
Benzo(b)fluoranthene	1100	NYSDEC TAGM	UG/KG	350	UR	450	U	430	U	46	J	32	J	2300	U
Benzo(g,h,i)perylene	50000	NYSDEC TAGM	UG/KG	350	UR	450	U	430	U	42	J	430	U	2300	U
Benzo(k)fluoranthene	1100	NYSDEC TAGM	UG/KG	350	UR	450	U	430	U	37	J	24	J	2300	U
Butylbenzylphthalate	50000	NYSDEC TAGM	UG/KG	350	UR	450	U	430	U	430	U	430	U	2300	U
Carbazole			UG/KG	350	UR	450	U	430	U	430	U	430	U	2300	U
Chrysene	400	NYSDEC TAGM	UG/KG	350	UR	450	U	430	U	55	J	38	J	2300	U
Di-n-butylphthalate	8100	NYSDEC TAGM	UG/KG	350	UR	340	J	480		500		430	U	1200	J
Dibenz(a,h)anthracene	14	NYSDEC TAGM	UG/KG	350	UR	450	U	430	U	430	U	430	U	2300	U
Fluoranthene	50000	NYSDEC TAGM	UG/KG	350	UR	31	J	23	J	88	J	52	J	2300	U
Indeno(1,2,3-cd)pyrene	3200	NYSDEC TAGM	UG/KG	350	UR	450	U	430	U	40	J	430	U	2300	U

Note: Shaded values exceed the NYSDEC TAGM.
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T. 4-31
SEAD-17 Summary of Analytes Detected in Surface Soil

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS17-15		SS17-16		SS17-17		SS17-18		SS17-18		SS17-19	
			SAMP ID:	SS17-15-1		SS17-16-1		SS17-17-1		SS17-18-1		SS17-24-1		SS17-19-1	
			QC CODE:	SA		SA		SA		SA		DU		SA	
			STUDY ID:	ESI		ESI		ESI		ESI		ESI		ESI	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	10/20/93		10/21/93		10/21/93		10/22/93		10/22/93		10/21/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
N-Nitrosodiphenylamine (1)			UG/KG	350	UR	450	U	430	U	430	U	430	U	2300	U
Naphthalene	13000	NYSDEC TAGM	UG/KG	350	UR	450	U	430	U	430	U	430	U	2300	U
Pentachlorophenol	1000	NYSDEC TAGM	UG/KG	850	UR	1100	U	1100	U	1100	U	1000	U	5500	U
Phenanthrene	50000	NYSDEC TAGM	UG/KG	350	UR	450	U	430	U	48	J	34	J	2300	U
Pyrene	50000	NYSDEC TAGM	UG/KG	350	UR	28	J	430	U	73	J	38	J	2300	U
bis(2-Chloroisopropyl) ether			UG/KG												
bis(2-Ethylhexyl)phthalate	50000	NYSDEC TAGM	UG/KG	350	UR	450	U	430	U	1200		1300		2300	U
PESTICIDES/PCB															
4,4'-DDD	2900	NYSDEC TAGM	UG/KG	3.5	U	4.5	U	4.3	U	4.3	U	4.3	U	15	
4,4'-DDE	2100	NYSDEC TAGM	UG/KG	3.5	U	4.5	U	4.3	U	17		17		2.5	J
4,4'-DDT	2100	NYSDEC TAGM	UG/KG	3.5	U	4.5	U	4.3	U	7		7.4		4.5	U
Aldrin	41	NYSDEC TAGM	UG/KG	1.8	U	2.3	U	2.2	U	2.2	U	2.2	U	2.3	U
Aroclor-1260	1000	NYSDEC TAGM	UG/KG	35	U	45	U	43	U	43	U	43	U	45	U
Dieldrin	44	NYSDEC TAGM	UG/KG	3.5	U	4.5	U	4.3	U	4.3	U	4.3	U	4.5	U
Endosulfan I	900	NYSDEC TAGM	UG/KG	1.8	U	2.3	U	2.2	U	2.2	U	2.2	U	2.3	U
Endrin	100	NYSDEC TAGM	UG/KG	3.5	U	4.5	U	4.3	U	4.3	U	4.3	U	4.5	U
Heptachlor epoxide	20	NYSDEC TAGM	UG/KG	1.8	U	2.3	U	2.2	U	1.1	J	2.2	U	2.3	U
OTHER ANALYSES															
Nitrate/Nitrite-Nitrogen			MG/KG	0.84		0.21		0.14		0.13		0.08		0.2	
Percent Moisture (PEST/PCB)															
Percent Moisture (SVOCs)															
Percent Moisture (VOCs)															
Percent Solids (Metals)															
Total Organic Carbon			MG/KG												
NITROAROMATICS															

Note: Shaded values exceed the NYSDEC TAGM.
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T. 4-31
SEAD-17 Summary of Analytes Detected in Surface Soil

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS17-15		SS17-16		SS17-17		SS17-18		SS17-18		SS17-19
			SAMP ID:	SS17-15-1		SS17-16-1		SS17-17-1		SS17-18-1		SS17-24-1		SS17-19-1
			QC CODE:	SA		SA		SA		SA		DU		SA
			STUDY ID:	ESI		ESI		ESI		ESI		ESI		ESI
			TOP:	0		0		0		0		0		0
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL
			SAMPLE DATE:	10/20/93		10/21/93		10/21/93		10/22/93		10/22/93		10/21/93
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
2,4-Dinitrotoluene			UG/KG	130	U	130	U	130	U	130	UR	72	J	130	U
METALS															
Aluminum	14592.8	NYSDEC TAGM	MG/KG	12600		**17300**		14100		14400		**18400**		**15500**	
Antimony	3.59	NYSDEC TAGM	MG/KG	9.8	U	12.4	UR	11.6	UR	15.3	R	**17.4**	**J**	9	UR
Arsenic	7.5	NYSDEC TAGM	MG/KG	6.1		6.5		5.7		**8.4**		**9.1**		6.3	
Barium	300	NYSDEC TAGM	MG/KG	122		210	R	132	R	452	R	**447**		149	R
Beryllium	0.73	NYSDEC TAGM	MG/KG	0.54	J	**0.82**	**J**	**0.74**	**J**	0.71		**0.87**	**J**	**0.83**	**J**
Cadmium	1	NYSDEC TAGM	MG/KG	0.93	J	**2.3**		**2**		**14.3**		**14.3**		**2.9**	
Calcium	101904	NYSDEC TAGM	MG/KG	37800		4760		3400		39800		27600		4210	
Chromium	22.13	NYSDEC TAGM	MG/KG	**23.1**		**23**		19.7		**23.9**		**27.2**		**22.9**	
Cobalt	30	NYSDEC TAGM	MG/KG	12		7.7	J	21.9		11.9		12.5		10.2	
Copper	25	NYSDEC TAGM	MG/KG	**94.5**		**182**		**47.8**		**409**		**378**	**J**	**81.7**	
Cyanide	0.3	NYSDEC TAGM	MG/KG	0.62	U	0.64	U	0.65	U	0.63	U	0.11	U	0.66	U
Iron	26626.7	NYSDEC TAGM	MG/KG	**27500**		24200		23400		25300		**28000**		25500	
Lead	21.86	NYSDEC TAGM	MG/KG	**472**		**595**		**373**		**2780**		**2310**		**402**	
Magnesium	12221.8	NYSDEC TAGM	MG/KG	8880		4170		3520		7590		6910		4260	
Manganese	669.38	NYSDEC TAGM	MG/KG	324	J	613		**880**		525		611		**741**	
Mercury	0.1	NYSDEC TAGM	MG/KG	0.05	J	**0.36**	**J**	0.07	J	0.09	J	0.07		0.07	J
Nickel	33.62	NYSDEC TAGM	MG/KG	**43.5**		25.2		23.5		**39.5**		**40.4**		30.2	
Potassium	1761.48	NYSDEC TAGM	MG/KG	**1810**		**1810**		1070	J	1570		**2260**		1610	
Selenium	2	NYSDEC TAGM	MG/KG	0.2	J	0.25	UJ	0.25	UJ	0.19	J	0.45	J	0.23	UJ
Silver	0.4	NYSDEC TAGM	MG/KG	1.2	U	1.6	UJ	1.5	UJ	**4.7**	**J**	**3.2**		1.1	UJ
Sodium	103.74	NYSDEC TAGM	MG/KG	**167**	**J**	56.6	J	71.3	J	**109**	**J**	**129**	**J**	59.5	J
Thallium	0.28	NYSDEC TAGM	MG/KG	0.21	U	0.27	U	0.28	U	0.19	U	0.27	U	0.25	U
Vanadium	150	NYSDEC TAGM	MG/KG	18.3		29.8		25.5		23.6		30		26.3	

Note: Shaded values exceed the NYSDEC TAGM.

Ta 4-31
SEAD-17 Summary of Analytes Detected in Surface Soil

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS17-15		SS17-16		SS17-17		SS17-18		SS17-18		SS17-19	
			SAMP ID:	SS17-15-1		SS17-16-1		SS17-17-1		SS17-18-1		SS17-24-1		SS17-19-1	
			QC CODE:	SA		SA		SA		SA		DU		SA	
			STUDY ID:	ESI		ESI		ESI		ESI		ESI		ESI	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	10/20/93		10/21/93		10/21/93		10/22/93		10/22/93		10/21/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Zinc	82.5	NYSDEC TAGM	MG/KG	**155**		**150**		**140**		**1530**		**1420**		**351**	
HERBICIDES															
MCPA			UG/KG	5300	U	6800	U	32000		6600	U	6600	U	6900	U

Note: Shaded values exceed the NYSDEC TAGM.
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Table 4-31
SEAD-17 Summary of Analytes Detected in Surface Soil

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS17-2		SS17-20		SS17-21		SS17-22		SS17-23		SS17-24	
			SAMP ID:	SS17-2-1		SS17-20-1		SS17-21-1		SS17-22-1		SS17-23-1		16072	
			QC CODE:	SA		SA		SA		SA		SA		SA	
			STUDY ID:	ESI		ESI		ESI		ESI		ESI		RI ROUND1	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	10/21/93		10/21/93		10/21/93		10/21/93		10/21/93		8/22/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
VOLATILE ORGANICS															
Acetone	200	NYSDEC TAGM	UG/KG	13	U	12	U	14	U	14	U	14	U	12	U
Benzene	60	NYSDEC TAGM	UG/KG	13	U	12	U	14	U	14	U	14	U	12	U
Methylene Chloride	100	NYSDEC TAGM	UG/KG	13	U	12	U	14	U	14	U	14	U	12	U
Toluene	1500	NYSDEC TAGM	UG/KG	13	U	12	U	14	U	14	U	14	U	12	UJ
SEMIVOLATILE ORGANICS															
2,4-Dinitrotoluene			UG/KG	450	U	420	U	430	U	430	U	430	U	390	U
2,6-Dinitrotoluene	1000	NYSDEC TAGM	UG/KG	450	U	420	U	430	U	430	U	430	U	390	U
2-Methylnaphthalene	36400	NYSDEC TAGM	UG/KG	450	U	420	U	430	U	430	U	430	U	390	U
3,3'-Dichlorobenzidine			UG/KG	450	U	420	U	430	U	430	U	430	U	390	UJ
3-Nitroaniline	500	NYSDEC TAGM	UG/KG	1100	U	1000	U	1100	U	1000	U	1000	U	940	UJ
4-Nitroaniline			UG/KG	1100	U	1000	U	1100	U	1000	U	1000	U	940	UJ
Anthracene	50000	NYSDEC TAGM	UG/KG	450	U	420	U	430	U	430	U	430	U	390	U
Benzo(a)anthracene	224	NYSDEC TAGM	UG/KG	23	J	420	U	430	U	21	J	430	U	390	U
Benzo(a)pyrene	61	NYSDEC TAGM	UG/KG	24	J	420	U	430	U	21	J	430	U	390	U
Benzo(b)fluoranthene	1100	NYSDEC TAGM	UG/KG	28	J	420	U	430	U	28	J	430	U	390	U
Benzo(g,h,i)perylene	50000	NYSDEC TAGM	UG/KG	31	J	420	U	430	U	430	U	430	U	390	U
Benzo(k)fluoranthene	1100	NYSDEC TAGM	UG/KG	450	U	420	U	430	U	21	J	430	U	390	U
Butylbenzylphthalate	50000	NYSDEC TAGM	UG/KG	450	U	420	U	430	U	430	U	430	U	390	U
Carbazole			UG/KG	450	U	420	U	430	U	430	U	430	U	390	UJ
Chrysene	400	NYSDEC TAGM	UG/KG	29	J	420	U	430	U	28	J	430	U	23	J
Di-n-butylphthalate	8100	NYSDEC TAGM	UG/KG	76	J	510		760		430	U	430	U	390	U
Dibenz(a,h)anthracene	14	NYSDEC TAGM	UG/KG	450	U	420	U	430	U	430	U	430	U	390	U
Fluoranthene	50000	NYSDEC TAGM	UG/KG	47	J	420	U	430	U	49	J	430	U	27	J
Indeno(1,2,3-cd)pyrene	3200	NYSDEC TAGM	UG/KG	30	J	420	U	430	U	430	U	430	U	390	U

Note: Shaded values exceed the NYSDEC TAGM.
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Table 4-31
SEAD-17 Summary of Analytes Detected in Surface Soil

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS17-2		SS17-20		SS17-21		SS17-22		SS17-23		SS17-24	
			SAMP ID:	SS17-2-1		SS17-20-1		SS17-21-1		SS17-22-1		SS17-23-1		16072	
			QC CODE:	SA		SA		SA		SA		SA		SA	
			STUDY ID:	ESI		ESI		ESI		ESI		ESI		RI ROUND1	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	10/21/93		10/21/93		10/21/93		10/21/93		10/21/93		8/22/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
N-Nitrosodiphenylamine (1)			UG/KG	450	U	420	U	430	U	430	U	430	U	390	U
Naphthalene	13000	NYSDEC TAGM	UG/KG	450	U	420	U	430	U	430	U	430	U	390	U
Pentachlorophenol	1000	NYSDEC TAGM	UG/KG	1100	U	1000	U	1100	U	1000	U	1000	U	940	UJ
Phenanthrene	50000	NYSDEC TAGM	UG/KG	450	U	420	U	430	U	20	J	430	U	18	J
Pyrene	50000	NYSDEC TAGM	UG/KG	47	J	420	U	430	U	40	J	430	U	36	J
bis(2-Chloroisopropyl) ether			UG/KG											390	U
bis(2-Ethylhexyl)phthalate	50000	NYSDEC TAGM	UG/KG	330	J	420	U	200	J	430	U	430	U	390	U
PESTICIDES/PCB															
4,4'-DDD	2900	NYSDEC TAGM	UG/KG	4.4	U	4.2	U	4.3	U	4.3	U	4.3	U	3.9	U
4,4'-DDE	2100	NYSDEC TAGM	UG/KG	4.4	U	4.2	U	4.3	U	4.3	U	4.3	U	3.9	U
4,4'-DDT	2100	NYSDEC TAGM	UG/KG	4.4	U	4.2	U	4.3	U	4.3	U	4.3	U	3.9	U
Aldrin	41	NYSDEC TAGM	UG/KG	2.3	U	2.2	U	2.2	U	2.2	U	2.2	U	2	U
Aroclor-1260	1000	NYSDEC TAGM	UG/KG	44	U	21	J	28	J	43	U	43	U	39	U
Dieldrin	44	NYSDEC TAGM	UG/KG	4.4	U	4.2	U	4.3	U	4.3	U	4.3	U	3.9	U
Endosulfan I	900	NYSDEC TAGM	UG/KG	2.3	U	2.2	U	2.2	U	2.2	U	2.2	U	2	U
Endrin	100	NYSDEC TAGM	UG/KG	4.4	U	4.2	U	4.3	U	4.3	U	4.3	U	3.9	U
Heptachlor epoxide	20	NYSDEC TAGM	UG/KG	2.3	U	2.2	U	2.2	U	2.2	U	2.2	U	2	U
OTHER ANALYSES															
Nitrate/Nitrite-Nitrogen			MG/KG	0.67		0.22		0.24		0.09		0.07		0.15	
Percent Moisture (PEST/PCB)														16	
Percent Moisture (SVOCs)														16	
Percent Moisture (VOCs)														18	
Percent Solids (Metals)														84.1	
Total Organic Carbon			MG/KG												
NITROAROMATICS															

Note: Shaded values exceed the NYSDEC TAGM.

T. 4-31
SEAD-17 Summary of Analytes Detected in Surface Soil

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS17-2		SS17-20		SS17-21		SS17-22		SS17-23		SS17-24	
			SAMP ID:	SS17-2-1		SS17-20-1		SS17-21-1		SS17-22-1		SS17-23-1		16072	
			QC CODE:	SA		SA		SA		SA		SA		SA	
			STUDY ID:	ESI		ESI		ESI		ESI		ESI		RI ROUND1	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	10/21/93		10/21/93		10/21/93		10/21/93		10/21/93		8/22/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
2,4-Dinitrotoluene			UG/KG	130	U	130	U	130	U	130	U	130	U	120	U
METALS															
Aluminum	14592.8	NYSDEC TAGM	MG/KG	**14900**		13900		14400		**18100**		**15700**		14400	J
Antimony	3.59	NYSDEC TAGM	MG/KG	12.9	UR	8.7	UR	11	UR	12.8	UJ	13.1	UJ	3.3	J
Arsenic	7.5	NYSDEC TAGM	MG/KG	5.4		6.5		**8.9**		5.9		5.3		5.4	
Barium	300	NYSDEC TAGM	MG/KG	122	R	96.2	R	96.5	R	127		92.6		140	
Beryllium	0.73	NYSDEC TAGM	MG/KG	0.58	J	0.71	J	**0.74**	**J**	**0.8**	**J**	0.72	J	0.56	
Cadmium	1	NYSDEC TAGM	MG/KG	**1.6**		0.54	U	0.69	U	**1.5**		0.82	U	**2.8**	
Calcium	101904	NYSDEC TAGM	MG/KG	2830		6230		3910		6900		2510		2300	
Chromium	22.13	NYSDEC TAGM	MG/KG	19		21.4		**23.2**		**23.8**		20.3		20.1	
Cobalt	30	NYSDEC TAGM	MG/KG	6.4	J	11.1		12.4		9.9	J	9.4	J	11	
Copper	25	NYSDEC TAGM	MG/KG	**54.4**		**26.9**		**25.9**		**52**	**J**	22.6	J	**59**	
Cyanide	0.3	NYSDEC TAGM	MG/KG	0.79	U	0.61	U	0.65	U	0.11	U	0.1	U	0.46	U
Iron	26626.7	NYSDEC TAGM	MG/KG	20800		**28700**		**28800**		24700		22700		25300	
Lead	21.86	NYSDEC TAGM	MG/KG	**371**		**69.2**		**44.9**		**226**		**111**		**496**	
Magnesium	12221.8	NYSDEC TAGM	MG/KG	3110		4770		4930		4880		3720		3340	
Manganese	669.38	NYSDEC TAGM	MG/KG	319		602		**857**		662		598		652	J
Mercury	0.1	NYSDEC TAGM	MG/KG	**1**	**J**	0.08	J	0.06	J	0.06	J	0.04	J	0.06	
Nickel	33.62	NYSDEC TAGM	MG/KG	18.3		31		**35.6**		27		22.6		21.2	
Potassium	1761.48	NYSDEC TAGM	MG/KG	1080		1270		1410		**1960**		1430		1230	
Selenium	2	NYSDEC TAGM	MG/KG	0.27	UJ	0.18	UJ	0.2	UJ	0.24	UJ	0.26	UJ	1	J
Silver	0.4	NYSDEC TAGM	MG/KG	1.3	UJ	1.1	UJ	1.4	UJ	1.6	U	1.7	U	**0.58**	
Sodium	103.74	NYSDEC TAGM	MG/KG	33.7	J	40.4	J	36.3	J	87	J	46	J	61.2	U
Thallium	0.28	NYSDEC TAGM	MG/KG	0.3	U	0.2	U	0.22	U	0.26	U	0.29	U	**1.5**	
Vanadium	150	NYSDEC TAGM	MG/KG	26.6		24		24.1		30.1		26.4		26.7	

Note: Shaded values exceed the NYSDEC TAGM.
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Table 4-31
SEAD-17 Summary of Analytes Detected in Surface Soil

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS17-2		SS17-20		SS17-21		SS17-22		SS17-23		SS17-24	
			SAMP ID:	SS17-2-1		SS17-20-1		SS17-21-1		SS17-22-1		SS17-23-1		16072	
			QC CODE:	SA		SA		SA		SA		SA		SA	
			STUDY ID:	ESI		ESI		ESI		ESI		ESI		RI ROUND1	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	10/21/93		10/21/93		10/21/93		10/21/93		10/21/93		8/22/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Zinc	82.5	NYSDEC TAGM	MG/KG	**136**		71.6		**83.9**		**196**		75.5		**222**	**J**
HERBICIDES															
MCPA			UG/KG	6700	U	6500	U	6600	U	6500	U	6600	U		

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-31
SEAD-17 Summary of Analytes Detected in Surface Soil

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS17-25		SS17-26		SS17-27		SS17-28		SS17-29		SS17-3	
			SAMP ID:	16073		16069		16063		16064		16065		SS17-3-1	
			QC CODE:	SA		SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		ESI	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/22/96		8/22/96		8/21/96		8/21/96		8/21/96		10/21/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
VOLATILE ORGANICS															
Acetone	200	NYSDEC TAGM	UG/KG	13	U	12	U	12	UJ	12	U	10	U	13	U
Benzene	60	NYSDEC TAGM	UG/KG	13	U	12	U	12	UJ	12	U	2	J	13	U
Methylene Chloride	100	NYSDEC TAGM	UG/KG	13	U	12	U	12	UJ	12	U	10	UJ	13	U
Toluene	1500	NYSDEC TAGM	UG/KG	13	U	12	U	12	UJ	12	U	8	J	13	U
SEMIVOLATILE ORGANICS															
2,4-Dinitrotoluene			UG/KG	410	U	390	U	400	U	390	U	340	U	430	U
2,6-Dinitrotoluene	1000	NYSDEC TAGM	UG/KG	410	U	390	U	400	U	390	U	340	U	430	U
2-Methylnaphthalene	36400	NYSDEC TAGM	UG/KG	410	U	390	U	400	U	390	U	130	J	430	U
3,3'-Dichlorobenzidine			UG/KG	410	J	390	U	400	U	390	U	340	U	430	U
3-Nitroaniline	500	NYSDEC TAGM	UG/KG	**990**	**J**	960	U	960	U	950	U	830	U	1000	U
4-Nitroaniline			UG/KG	990	J	960	U	960	U	950	U	830	U	1000	U
Anthracene	50000	NYSDEC TAGM	UG/KG	410	U	390	U	400	U	390	U	340	U	430	U
Benzo(a)anthracene	224	NYSDEC TAGM	UG/KG	410	U	390	U	400	U	390	U	340	U	430	U
Benzo(a)pyrene	61	NYSDEC TAGM	UG/KG	410	U	25	J	400	U	390	U	340	U	430	U
Benzo(b)fluoranthene	1100	NYSDEC TAGM	UG/KG	410	U	390	U	400	U	390	U	340	U	430	U
Benzo(g,h,i)perylene	50000	NYSDEC TAGM	UG/KG	410	U	82	J	400	U	390	U	340	U	430	U
Benzo(k)fluoranthene	1100	NYSDEC TAGM	UG/KG	410	U	390	U	400	U	390	U	340	U	430	U
Butylbenzylphthalate	50000	NYSDEC TAGM	UG/KG	410	U	390	U	400	U	390	U	340	U	430	U
Carbazole			UG/KG	410	J	390	UJ	400	U	390	U	340	U	430	U
Chrysene	400	NYSDEC TAGM	UG/KG	19	J	21	J	400	U	390	U	340	U	430	U
Di-n-butylphthalate	8100	NYSDEC TAGM	UG/KG	410	U	390	U	400	U	390	U	340	U	45	J
Dibenz(a,h)anthracene	14	NYSDEC TAGM	UG/KG	410	U	390	U	**59**	**J**	**55**	**J**	340	U	430	U
Fluoranthene	50000	NYSDEC TAGM	UG/KG	23	J	28	J	400	U	390	U	340	U	430	U
Indeno(1,2,3-cd)pyrene	3200	NYSDEC TAGM	UG/KG	410	U	390	U	400	U	390	U	340	U	430	U

Note: **Shaded values exceed** the NYSDEC TAGM.

Table 4-31
SEAD-17 Summary of Analytes Detected in Surface Soil

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS17-25		SS17-26		SS17-27		SS17-28		SS17-29		SS17-3	
			SAMP ID:	16073		16069		16063		16064		16065		SS17-3-1	
			QC CODE:	SA		SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		ESI	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/22/96		8/22/96		8/21/96		8/21/96		8/21/96		10/21/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
N-Nitrosodiphenylamine (1)			UG/KG	410	U	390	U	400	U	390	U	340	U	430	U
Naphthalene	13000	NYSDEC TAGM	UG/KG	410	U	390	U	400	U	390	U	37	J	430	U
Pentachlorophenol	1000	NYSDEC TAGM	UG/KG	990	J	1700	UJ	960	U	950	U	830	U	1000	U
Phenanthrene	50000	NYSDEC TAGM	UG/KG	410	U	20	J	400	U	390	U	340	U	430	U
Pyrene	50000	NYSDEC TAGM	UG/KG	29	J	50	J	400	U	390	U	340	U	430	U
bis(2-Chloroisopropyl) ether			UG/KG	410	J	390	U	400	U	390	U	340	U		
bis(2-Ethylhexyl)phthalate	50000	NYSDEC TAGM	UG/KG	410	U	390	U	400	U	390	U	340	U	290	J
PESTICIDES/PCB															
4,4'-DDD	2900	NYSDEC TAGM	UG/KG	4.1	U	4	U	4	U	3.9	U	1.7	J	4.3	U
4,4'-DDE	2100	NYSDEC TAGM	UG/KG	4.1	U	4	U	24		3.7	U	2.2	J	4.3	U
4,4'-DDT	2100	NYSDEC TAGM	UG/KG	4.1	U	4	U	16		2.7	J	3.4	U	4.3	U
Aldrin	41	NYSDEC TAGM	UG/KG	2.1	U	2	U	2	U	2	U	1.9		2.2	U
Aroclor-1260	1000	NYSDEC TAGM	UG/KG	41	U	40	U	40	U	39	U	34	U	43	U
Dieldrin	44	NYSDEC TAGM	UG/KG	12	J	4	U	13		**80**	**J**	3.4	U	4.3	U
Endosulfan I	900	NYSDEC TAGM	UG/KG	2.1	U	2	U	1.4	U	2	U	1.8	U	2.2	U
Endrin	100	NYSDEC TAGM	UG/KG	4.1	U	4	U	4	U	3.9	U	3.4	U	4.3	U
Heptachlor epoxide	20	NYSDEC TAGM	UG/KG	2.1	U	2	U	2	U	2	U	1.8	U	2.2	U
OTHER ANALYSES															
Nitrate/Nitrite-Nitrogen			MG/KG	0.07		0.1		0.06		0.12		0.53		0.13	
Percent Moisture (PEST/PCB)				19		17		17		16		4			
Percent Moisture (SVOCs)				19		17		17		16		4			
Percent Moisture (VOCs)				25		17		17		16		3			
Percent Solids (Metals)				80.9		83.4		82.9		84		96.1			
Total Organic Carbon			MG/KG			40900									
NITROAROMATICS															

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-31
SEAD-17 Summary of Analytes Detected in Surface Soil

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS17-25		SS17-26		SS17-27		SS17-28		SS17-29		SS17-3	
			SAMP ID:	16073		16069		16063		16064		16065		SS17-3-1	
			QC CODE:	SA		SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		ESI	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/22/96		8/22/96		8/21/96		8/21/96		8/21/96		10/21/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
2,4-Dinitrotoluene			UG/KG	120	U	120	U	120	U	120	U	120	U	130	U
METALS															
Aluminum	14592.8	NYSDEC TAGM	MG/KG	16700	J	16000	J	14900	J	14100	J	12100	J	15200	
Antimony	3.59	NYSDEC TAGM	MG/KG	3.9	J	5	J	12.7	J	2.7	J	2	J	13.6	UR
Arsenic	7.5	NYSDEC TAGM	MG/KG	6.2		6.5		6.1		5		4		5	
Barium	300	NYSDEC TAGM	MG/KG	192	J	164	J	387	J	141	J	153	J	102	R
Beryllium	0.73	NYSDEC TAGM	MG/KG	0.64		0.51		0.61		0.58		0.52		0.42	J
Cadmium	1	NYSDEC TAGM	MG/KG	3.5		3.6		15		5.6		0.93		2.2	
Calcium	101904	NYSDEC TAGM	MG/KG	3940		2500		34900		7310		42500		2180	
Chromium	22.13	NYSDEC TAGM	MG/KG	22.3		22.2		22.9		21.7		23.3		16.8	
Cobalt	30	NYSDEC TAGM	MG/KG	11.3		11.5		11.6		10.2		13.5		5.7	J
Copper	25	NYSDEC TAGM	MG/KG	58.2		80.6		480		141		71.2		39.3	
Cyanide	0.3	NYSDEC TAGM	MG/KG	0.61	U	0.57	U	0.58	U	0.56	U	0.52	U	0.75	U
Iron	26626.7	NYSDEC TAGM	MG/KG	25500		26800		23300	J	24200	J	26100	J	19300	
Lead	21.86	NYSDEC TAGM	MG/KG	448		697		2740		524		254		375	
Magnesium	12221.8	NYSDEC TAGM	MG/KG	3500		3260		6210		4380		6390		2540	
Manganese	669.38	NYSDEC TAGM	MG/KG	996	J	950	J	573		579		404		277	
Mercury	0.1	NYSDEC TAGM	MG/KG	0.07		0.11		0.12		0.06		0.06		0.07	J
Nickel	33.62	NYSDEC TAGM	MG/KG	23.4		22.3		30.6		32.6		47.8		14.1	
Potassium	1761.48	NYSDEC TAGM	MG/KG	1540		1390		1520		1370		1660		1060	J
Selenium	2	NYSDEC TAGM	MG/KG	1.2	J	1.7	J	1.1		0.79		0.65	U	0.37	J
Silver	0.4	NYSDEC TAGM	MG/KG	0.29	U	0.55		2.9		1.1		0.24	U	1.7	UJ
Sodium	103.74	NYSDEC TAGM	MG/KG	60.7	U	60	U	198		119		131		33.5	J
Thallium	0.28	NYSDEC TAGM	MG/KG	1.1		1.5		0.98	J	0.9	J	0.8	J	0.26	U
Vanadium	150	NYSDEC TAGM	MG/KG	29.3		29.7		23.4		21.2		16.7		29.2	

Note: **Shaded values exceed the** NYSDEC TAGM.
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Table 4-31
SEAD-17 Summary of Analytes Detected in Surface Soil

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS17-25		SS17-26		SS17-27		SS17-28		SS17-29		SS17-3	
			SAMP ID:	16073		16069		16063		16064		16065		SS17-3-1	
			QC CODE:	SA		SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		ESI	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/22/96		8/22/96		8/21/96		8/21/96		8/21/96		10/21/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Zinc	82.5	NYSDEC TAGM	MG/KG	**284**	**J**	**233**	**J**	**901**		**468**		79.5		**129**	
HERBICIDES															
MCPA			UG/KG											6500	U

Note: Shaded values exceed the NYSDEC TAGM.
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T 4-31
SEAD-17 Summary of Analytes Detected in Surface Soil

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS17-30		SS17-31		SS17-34		SS17-35		SS17-36		SS17-37
			SAMP ID:	16070		16071		16079		16078		16077		16080
			QC CODE:	SA		SA		SA		SA		SA		SA
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1
			TOP:	0		0		0		0		0		0
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL
			SAMPLE DATE:	8/22/96		8/22/96		8/22/96		8/22/96		8/22/96		8/22/96
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE
VOLATILE ORGANICS														
Acetone	200	NYSDEC TAGM	UG/KG	12	U	8	J	11	U	12	U	12	U	11
Benzene	60	NYSDEC TAGM	UG/KG	12	U	12	U	11	U	12	U	12	U	11
Methylene Chloride	100	NYSDEC TAGM	UG/KG	12	U	12	U	11	U	12	U	12	U	11
Toluene	1500	NYSDEC TAGM	UG/KG	12	U	12	UJ	11	UJ	12	UJ	12	U	11
SEMIVOLATILE ORGANICS														
2,4-Dinitrotoluene			UG/KG	380	U	380	U	360	U	410	U	390	U	85
2,6-Dinitrotoluene	1000	NYSDEC TAGM	UG/KG	380	U	380	U	360	U	410	U	390	U	350
2-Methylnaphthalene	36400	NYSDEC TAGM	UG/KG	380	U	380	U	360	U	410	U	390	U	350
3,3'-Dichlorobenzidine			UG/KG	380	UJ	380	UJ	360	UJ	410	UJ	390	UJ	350
3-Nitroaniline	500	NYSDEC TAGM	UG/KG	920	UJ	930	UJ	880	UJ	990	UJ	940	UJ	860
4-Nitroaniline			UG/KG	920	UJ	930	UJ	880	UJ	990	UJ	940	UJ	860
Anthracene	50000	NYSDEC TAGM	UG/KG	380	U	380	U	360	U	410	U	390	U	350
Benzo(a)anthracene	224	NYSDEC TAGM	UG/KG	19	J	380	U	360	U	410	U	390	U	37
Benzo(a)pyrene	61	NYSDEC TAGM	UG/KG	18	J	380	U	360	U	25	J	390	U	34
Benzo(b)fluoranthene	1100	NYSDEC TAGM	UG/KG	49	J	20	J	360	U	410	U	390	U	65
Benzo(g,h,i)perylene	50000	NYSDEC TAGM	UG/KG	380	U	380	U	360	U	410	U	390	U	44
Benzo(k)fluoranthene	1100	NYSDEC TAGM	UG/KG	380	U	18	J	360	U	410	U	390	U	35
Butylbenzylphthalate	50000	NYSDEC TAGM	UG/KG	380	U	380	U	360	U	410	U	390	U	350
Carbazole			UG/KG	380	UJ	380	UJ	360	UJ	410	UJ	390	UJ	350
Chrysene	400	NYSDEC TAGM	UG/KG	22	J	21	J	19	J	20	J	390	U	63
Di-n-butylphthalate	8100	NYSDEC TAGM	UG/KG	380	U	380	U	360	U	410	U	390	U	550
Dibenz(a,h)anthracene	14	NYSDEC TAGM	UG/KG	380	U	380	U	360	U	410	U	390	U	350
Fluoranthene	50000	NYSDEC TAGM	UG/KG	28	J	26	J	26	J	24	J	390	U	74
Indeno(1,2,3-cd)pyrene	3200	NYSDEC TAGM	UG/KG	380	U	380	U	360	U	410	U	390	U	33

Note: Shaded values exceed the NYSDEC TAGM.
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Table 4-31

SEAD-17 Summary of Analytes Detected in Surface Soil

SEAD-17 Remedial Investigation

Seneca Army Depot Activity

			LOC_ID:	SS17-30		SS17-31		SS17-34		SS17-35		SS17-36		SS17-37
			SAMP ID:	16070		16071		16079		16078		16077		16080
			QC CODE:	SA		SA		SA		SA		SA		SA
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1
			TOP:	0		0		0		0		0		0
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL
			SAMPLE DATE:	8/22/96		8/22/96		8/22/96		8/22/96		8/22/96		8/22/96
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE
N-Nitrosodiphenylamine (1)			UG/KG	380	U	380	U	360	U	410	U	390	U	71
Naphthalene	13000	NYSDEC TAGM	UG/KG	380	U	380	U	360	U	410	U	390	U	350
Pentachlorophenol	1000	NYSDEC TAGM	UG/KG	43	J	930	UJ	880	UJ	990	UJ	940	UJ	860
Phenanthrene	50000	NYSDEC TAGM	UG/KG	380	U	380	U	360	U	410	U	390	U	56
Pyrene	50000	NYSDEC TAGM	UG/KG	34	J	32	J	29	J	30	J	390	U	82
bis(2-Chloroisopropyl) ether			UG/KG	380	U	380	U	360	U	410	U	390	U	350
bis(2-Ethylhexyl)phthalate	50000	NYSDEC TAGM	UG/KG	380	U	380	U	360	U	410	U	390	U	350
PESTICIDES/PCB														
4,4'-DDD	2900	NYSDEC TAGM	UG/KG	3.8	U	3.9	U	3.7	U	4.1	U	3.8	U	2.6
4,4'-DDE	2100	NYSDEC TAGM	UG/KG	3.8	U	3.9	U	3.7	U	4.1	U	5		27
4,4'-DDT	2100	NYSDEC TAGM	UG/KG	3.8	U	3.9	U	3.7	U	4.1	U	3.8	U	14
Aldrin	41	NYSDEC TAGM	UG/KG	2	U	2	U	1.9	U	2.1	U	2	U	1.8
Aroclor-1260	1000	NYSDEC TAGM	UG/KG	38	U	39	U	37	U	41	U	38	U	28
Dieldrin	44	NYSDEC TAGM	UG/KG	4	U	3.9	U	3.7	U	12	J	3.8	U	22
Endosulfan I	900	NYSDEC TAGM	UG/KG	2	U	2	U	1.9	U	2.1	U	2	U	2.4
Endrin	100	NYSDEC TAGM	UG/KG	3.8	U	3.9	U	3.7	U	4.1	U	3.8	U	1.8
Heptachlor epoxide	20	NYSDEC TAGM	UG/KG	2	U	2	U	1.9	U	2.1	U	2	U	1.8
OTHER ANALYSES														
Nitrate/Nitrite-Nitrogen			MG/KG	0.07		0.11		0.08		0.22		0.26		0.44
Percent Moisture (PEST/PCB)				14		15		10		20		14		7
Percent Moisture (SVOCs)				14		15		10		20		15		7
Percent Moisture (VOCs)				15		17		13		20		15		9
Percent Solids (Metals)				85.7		84.7		89.7		80.3		85.5		92.9
Total Organic Carbon			MG/KG											32700
NITROAROMATICS														

Note: Shaded values exceed the NYSDEC TAGM.
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SEAD-17 Summary of Analytes Detected in Surface Soil

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS17-30		SS17-31		SS17-34		SS17-35		SS17-36		SS17-37
			SAMP ID:	16070		16071		16079		16078		16077		16080
			QC CODE:	SA		SA		SA		SA		SA		SA
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1
			TOP:	0		0		0		0		0		0
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL
			SAMPLE DATE:	8/22/96		8/22/96		8/22/96		8/22/96		8/22/96		8/22/96
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE
2,4-Dinitrotoluene			UG/KG	120	U	120	U	120	U	120	U	120	U	120
METALS														
Aluminum	14592.8	NYSDEC TAGM	MG/KG	14400	J	13200	J	6720	J	11700		**14900**	**J**	10200
Antimony	3.59	NYSDEC TAGM	MG/KG	1.4	J	3.4	J	1.5	J	2.6	J	**4**	**J**	**40.1**
Arsenic	7.5	NYSDEC TAGM	MG/KG	4		4.1		4.2		4.2		5.5		**7.7**
Barium	300	NYSDEC TAGM	MG/KG	97.7	J	123	J	90.4	J	156	J	237	J	**524**
Beryllium	0.73	NYSDEC TAGM	MG/KG	0.48		0.43		0.25		0.45		0.62		0.36
Cadmium	1	NYSDEC TAGM	MG/KG	0.53		**1.6**		**2.1**		**3.3**		**3.4**		**25.5**
Calcium	101904	NYSDEC TAGM	MG/KG	2180		2260		**166000**		18900		5880		**117000**
Chromium	22.13	NYSDEC TAGM	MG/KG	18.1		16.7		9.7		16.7		21.3		19.7
Cobalt	30	NYSDEC TAGM	MG/KG	8.4		7.4		7.5		7.6		10.7		9.7
Copper	25	NYSDEC TAGM	MG/KG	**36.7**		**67.6**		**39.3**		**62.4**		**142**		**837**
Cyanide	0.3	NYSDEC TAGM	MG/KG	0.53	U	0.59	U	**1.5**		**0.78**	**J**	0.48	U	0.52
Iron	26626.7	NYSDEC TAGM	MG/KG	21100		18100		11800		18400		24700		18700
Lead	21.86	NYSDEC TAGM	MG/KG	**172**		**450**		**265**		**534**		**815**		**6270**
Magnesium	12221.8	NYSDEC TAGM	MG/KG	2950		2850		8660		3380		4020		7880
Manganese	669.38	NYSDEC TAGM	MG/KG	430	J	304	J	531	J	517	J	608	J	371
Mercury	0.1	NYSDEC TAGM	MG/KG	0.09		0.06		0.05		0.07		0.09		0.05
Nickel	33.62	NYSDEC TAGM	MG/KG	17.5		16.6		16.2		19.2		26.3		**35.9**
Potassium	1761.48	NYSDEC TAGM	MG/KG	975		983		1090		1390		1610		1750
Selenium	2	NYSDEC TAGM	MG/KG	0.99	J	0.98	J	0.64	J	1	J	0.68	J	0.98
Silver	0.4	NYSDEC TAGM	MG/KG	0.3	U	0.29	U	**0.49**		**0.71**		**1.1**		**9**
Sodium	103.74	NYSDEC TAGM	MG/KG	62.5	U	60.2	U	53.8	U	64.1	U	58.5	U	**248**
Thallium	0.28	NYSDEC TAGM	MG/KG	0.98	U	0.94	U	0.84	U	1	U	0.92	U	0.8
Vanadium	150	NYSDEC TAGM	MG/KG	26		23.2		14		21.4		27.1		16.8

Note: Shaded values exceed the NYSDEC TAGM.
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Table 4-31
SEAD-17 Summary of Analytes Detected in Surface Soil

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS17-30		SS17-31		SS17-34		SS17-35		SS17-36		SS17-37
			SAMP ID:	16070		16071		16079		16078		16077		16080
			QC CODE:	SA		SA		SA		SA		SA		SA
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1
			TOP:	0		0		0		0		0		0
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL
			SAMPLE DATE:	8/22/96		8/22/96		8/22/96		8/22/96		8/22/96		8/22/96
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE
Zinc	82.5	NYSDEC TAGM	MG/KG	**93**	**J**	**139**	**J**	**167**	**J**	**207**	**J**	**488**	**J**	**1470**
HERBICIDES														
MCPA			UG/KG											

Note: Shaded values exceed the NYSDEC TAGM.
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T. 4-31
SEAD-17 Summary of Analytes Detected in Surface Soil

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:		SS17-38		SS17-39		SS17-4		SS17-5		SS17-6		SS17-7	
			SAMP ID:		16076		16075		SS17-4-1		SS17-5-1		SS17-6-1		SS17-7-1	
			QC CODE:		SA		SA		SA		SA		SA		SA	
			STUDY ID:		RI ROUND1		RI ROUND1		ESI		ESI		ESI		ESI	
			TOP:		0		0		0		0		0		0	
			BOTTOM:		0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:		8/22/96		8/22/96		10/21/93		10/21/93		10/21/93		10/21/93	
PARAMETER	LEVEL	SOURCE	UNIT	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
VOLATILE ORGANICS																
Acetone	200	NYSDEC TAGM	UG/KG	U	12	U	13	U	12	U	14	U	10	U	12	U
Benzene	60	NYSDEC TAGM	UG/KG	UJ	12	U	13	U	12	U	14	U	10	U	12	U
Methylene Chloride	100	NYSDEC TAGM	UG/KG	U	12	U	13	U	12	U	14	U	10	U	12	U
Toluene	1500	NYSDEC TAGM	UG/KG	UJ	12	UJ	13	U	12	U	14	U	10	U	12	U
SEMIVOLATILE ORGANICS																
2,4-Dinitrotoluene			UG/KG	J	400	U	410	U	1400		430	U	340	U	410	U
2,6-Dinitrotoluene	1000	NYSDEC TAGM	UG/KG	U	400	U	410	U	70	J	430	U	340	U	410	U
2-Methylnaphthalene	36400	NYSDEC TAGM	UG/KG	U	400	U	410	U	410	U	430	U	340	U	410	U
3,3'-Dichlorobenzidine			UG/KG	UJ	400	UJ	410	UJ	410	U	430	U	340	U	410	U
3-Nitroaniline	500	NYSDEC TAGM	UG/KG	UJ	970	UJ	1000	UJ	990	U	1000	U	830	U	990	U
4-Nitroaniline			UG/KG	UJ	970	UJ	1000	UJ	990	U	1000	U	830	U	990	U
Anthracene	50000	NYSDEC TAGM	UG/KG	U	400	U	410	U	410	U	430	U	340	U	410	U
Benzo(a)anthracene	224	NYSDEC TAGM	UG/KG	J	400	U	410	U	22	J	430	U	19	J	410	U
Benzo(a)pyrene	61	NYSDEC TAGM	UG/KG	J	400	U	19	J	410	U	430	U	340	U	410	U
Benzo(b)fluoranthene	1100	NYSDEC TAGM	UG/KG	J	400	U	410	U	28	J	430	U	26	J	410	U
Benzo(g,h,i)perylene	50000	NYSDEC TAGM	UG/KG	J	400	U	410	U	28	J	22	J	340	U	410	U
Benzo(k)fluoranthene	1100	NYSDEC TAGM	UG/KG	J	400	U	410	U	410	U	430	U	18	J	410	U
Butylbenzylphthalate	50000	NYSDEC TAGM	UG/KG	U	400	U	410	U	410	U	430	U	37	J	410	U
Carbazole			UG/KG	UJ	400	UJ	410	UJ	410	U	430	U	340	U	410	U
Chrysene	400	NYSDEC TAGM	UG/KG	J	18	J	21	J	32	J	430	U	31	J	410	U
Di-n-butylphthalate	8100	NYSDEC TAGM	UG/KG		400	U	410	U	89	J	87	J	60	J	97	J
Dibenz(a,h)anthracene	14	NYSDEC TAGM	UG/KG	U	400	U	410	U	410	U	430	U	340	U	410	U
Fluoranthene	50000	NYSDEC TAGM	UG/KG	J	25	J	30	J	54	J	33	J	48	J	21	J
Indeno(1,2,3-cd)pyrene	3200	NYSDEC TAGM	UG/KG	J	400	U	410	U	410	U	430	U	340	U	410	U

Note: Shaded values exceed the NYSDEC TAGM.
h:\eng\seneca\s1617ri\tables\s17ssclp.xls

Table 4-31
SEAD-17 Summary of Analytes Detected in Surface Soil

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:		SS17-38		SS17-39		SS17-4		SS17-5		SS17-6		SS17-7	
			SAMP ID:		16076		16075		SS17-4-1		SS17-5-1		SS17-6-1		SS17-7-1	
			QC CODE:		SA		SA		SA		SA		SA		SA	
			STUDY ID:		RI ROUND1		RI ROUND1		ESI		ESI		ESI		ESI	
			TOP:		0		0		0		0		0		0	
			BOTTOM:		0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:		8/22/96		8/22/96		10/21/93		10/21/93		10/21/93		10/21/93	
PARAMETER	LEVEL	SOURCE	UNIT	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
N-Nitrosodiphenylamine (1)			UG/KG	J	400	U	410	U	27	J	430	U	340	U	410	U
Naphthalene	13000	NYSDEC TAGM	UG/KG	U	400	U	410	U	410	U	430	U	340	U	410	U
Pentachlorophenol	1000	NYSDEC TAGM	UG/KG	UJ	970	UJ	1000	UJ	990	U	1000	U	830	U	990	U
Phenanthrene	50000	NYSDEC TAGM	UG/KG	J	19	J	20	J	33	J	430	U	36	J	410	J
Pyrene	50000	NYSDEC TAGM	UG/KG	J	31	J	36	J	44	J	33	J	43	J	410	U
bis(2-Chloroisopropyl) ether			UG/KG	U	400	U	410	U								
bis(2-Ethylhexyl)phthalate	50000	NYSDEC TAGM	UG/KG	U	400	U	410	U	390	J	600		340	U	650	
PESTICIDES/PCB																
4,4'-DDD	2900	NYSDEC TAGM	UG/KG	J	4	U	4.2	U	4.1	U	4.3	U	3.4	U	4	U
4,4'-DDE	2100	NYSDEC TAGM	UG/KG		4	U	4.2	U	22		4.3	U	11		3.2	J
4,4'-DDT	2100	NYSDEC TAGM	UG/KG	J	4	U	4.2	U	2.6	J	4.3	U	1.9	J	4	U
Aldrin	41	NYSDEC TAGM	UG/KG	U	2.1	U	2.1	U	2.1	U	2.2	U	1.8	U	2.1	U
Aroclor-1260	1000	NYSDEC TAGM	UG/KG	J	40	U	42	U	41	U	43	U	34	U	40	U
Dieldrin	44	NYSDEC TAGM	UG/KG		4	U	4.2	U	4.1	U	4.3	U	3.4	U	4	U
Endosulfan I	900	NYSDEC TAGM	UG/KG	J	2.1	U	2.1	U	2.1	U	2.2	U	1.8	U	2.1	U
Endrin	100	NYSDEC TAGM	UG/KG	J	4	U	4.2	U	4.1	U	4.3	U	3.4	U	4	U
Heptachlor epoxide	20	NYSDEC TAGM	UG/KG	U	2.1	U	2.1	U	2.1	U	2.2	U	1.8	U	2.1	U
OTHER ANALYSES																
Nitrate/Nitrite-Nitrogen			MG/KG		0.28		0.34		0.51		0.17		3.8		0.15	
Percent Moisture (PEST/PCB)					18		21									
Percent Moisture (SVOCs)					18		21									
Percent Moisture (VOCs)					19		24									
Percent Solids (Metals)					81.9		79.2									
Total Organic Carbon			MG/KG													
NITROAROMATICS																

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-31
SEAD-17 Summary of Analytes Detected in Surface Soil

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:		SS17-38		SS17-39		SS17-4		SS17-5		SS17-6		SS17-7	
			SAMP ID:		16076		16075		SS17-4-1		SS17-5-1		SS17-6-1		SS17-7-1	
			QC CODE:		SA		SA		SA		SA		SA		SA	
			STUDY ID:		RI ROUND1		RI ROUND1		ESI		ESI		ESI		ESI	
			TOP:		0		0		0		0		0		0	
			BOTTOM:		0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:		8/22/96		8/22/96		10/21/93		10/21/93		10/21/93		10/21/93	
PARAMETER	LEVEL	SOURCE	UNIT	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
2,4-Dinitrotoluene			UG/KG	U	120	U	120	U	130	U	130	U	170		130	U
METALS																
Aluminum	14592.8	NYSDEC TAGM	MG/KG	J	11700	J	14400	J	10800		17300		10900		16600	
Antimony	3.59	NYSDEC TAGM	MG/KG	J	1.4	J	1.6	J	12.5	UR	10	UR	12.9	R	8.2	JR
Arsenic	7.5	NYSDEC TAGM	MG/KG		4.2		4.4		6.6		7.4		16.1		8.2	
Barium	300	NYSDEC TAGM	MG/KG	J	103	J	156	J	192	R	146	R	352	R	447	R
Beryllium	0.73	NYSDEC TAGM	MG/KG		0.48		0.83		0.52	J	0.81	J	0.5	J	0.76	J
Cadmium	1	NYSDEC TAGM	MG/KG		0.59		0.5		4.9		3.7		9.9		7.3	
Calcium	101904	NYSDEC TAGM	MG/KG		2780		5280		117000		2740		89300		3780	
Chromium	22.13	NYSDEC TAGM	MG/KG		16.5		20.1		18.3		23.6		22.5		23.4	
Cobalt	30	NYSDEC TAGM	MG/KG		7.9		7.4		10.4	J	9.6		11.3		14.7	
Copper	25	NYSDEC TAGM	MG/KG		29.7		46.2		249		73		362		423	
Cyanide	0.3	NYSDEC TAGM	MG/KG	U	0.56	U	0.57	U	0.68	U	0.78	U	0.46	U	0.61	U
Iron	26626.7	NYSDEC TAGM	MG/KG		19200		22500		19400		25000		24300		26400	
Lead	21.86	NYSDEC TAGM	MG/KG		163		183		1680		577		3150		2310	
Magnesium	12221.8	NYSDEC TAGM	MG/KG		3060		3820		6900		3670		8840		4520	
Manganese	669.38	NYSDEC TAGM	MG/KG	J	475	J	256	J	431		737		399		431	
Mercury	0.1	NYSDEC TAGM	MG/KG		0.07		0.09		0.07	J	0.9	J	0.06	J	0.1	J
Nickel	33.62	NYSDEC TAGM	MG/KG		17.6		23.5		28		24.9		37.7		29.1	
Potassium	1761.48	NYSDEC TAGM	MG/KG		1060		1410		1380		1520		1420		1370	
Selenium	2	NYSDEC TAGM	MG/KG	J	0.82	J	1.2	J	0.36	J	0.23	UJ	0.68	J	0.25	UJ
Silver	0.4	NYSDEC TAGM	MG/KG		0.31	U	0.45		1.6	UJ	1.3	UJ	2.8	J	1	UJ
Sodium	103.74	NYSDEC TAGM	MG/KG		64.7	U	64.4	U	144	J	53.1	J	168	J	66.9	J
Thallium	0.28	NYSDEC TAGM	MG/KG	U	1	U	1	U	0.25	U	0.25	U	2	U	0.27	U
Vanadium	150	NYSDEC TAGM	MG/KG		21.2		25.2		17.5		29.7		16.3		28.8	

Note: **Shaded values exceed the** NYSDEC TAGM.
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Table 4-31
SEAD-17 Summary of Analytes Detected in Surface Soil

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:		SS17-38		SS17-39		SS17-4		SS17-5		SS17-6		SS17-7	
			SAMP ID:		16076		16075		SS17-4-1		SS17-5-1		SS17-6-1		SS17-7-1	
			QC CODE:		SA		SA		SA		SA		SA		SA	
			STUDY ID:		RI ROUND1		RI ROUND1		ESI		ESI		ESI		ESI	
			TOP:		0		0		0		0		0		0	
			BOTTOM:		0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:		8/22/96		8/22/96		10/21/93		10/21/93		10/21/93		10/21/93	
PARAMETER	LEVEL	SOURCE	UNIT	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Zinc	82.5	NYSDEC TAGM	MG/KG	J	84.1	J	84.8	J	324		237		497		437	
HERBICIDES																
MCPA			UG/KG						6200	U	34000		5200	U	12000	

Note: Shaded values exceed the NYSDEC TAGM.
h:\eng\seneca\s1617ri\tables\s17ssclp.xls

Table 4-31
SEAD-17 Summary of Analytes Detected in Surface Soil

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS17-8		SS17-9	
			SAMP ID:	SS17-8-1		SS17-9-1	
			QC CODE:	SA		SA	
			STUDY ID:	ESI		ESI	
			TOP:	0		0	
			BOTTOM:	0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	10/21/93		10/20/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q
VOLATILE ORGANICS							
Acetone	200	NYSDEC TAGM	UG/KG	12	U	10	UJ
Benzene	60	NYSDEC TAGM	UG/KG	12	U	10	UJ
Methylene Chloride	100	NYSDEC TAGM	UG/KG	12	U	10	UJ
Toluene	1500	NYSDEC TAGM	UG/KG	12	U	4	J
SEMIVOLATILE ORGANICS							
2,4-Dinitrotoluene			UG/KG	410	U	340	U
2,6-Dinitrotoluene	1000	NYSDEC TAGM	UG/KG	410	U	340	U
2-Methylnaphthalene	36400	NYSDEC TAGM	UG/KG	410	U	340	U
3,3'-Dichlorobenzidine			UG/KG	410	U	340	U
3-Nitroaniline	500	NYSDEC TAGM	UG/KG	1000	U	830	U
4-Nitroaniline			UG/KG	1000	U	830	U
Anthracene	50000	NYSDEC TAGM	UG/KG	410	U	340	U
Benzo(a)anthracene	224	NYSDEC TAGM	UG/KG	30	J	16	J
Benzo(a)pyrene	61	NYSDEC TAGM	UG/KG	24	J	340	U
Benzo(b)fluoranthene	1100	NYSDEC TAGM	UG/KG	27	J	17	J
Benzo(g,h,i)perylene	50000	NYSDEC TAGM	UG/KG	410	U	340	U
Benzo(k)fluoranthene	1100	NYSDEC TAGM	UG/KG	23	J	17	J
Butylbenzylphthalate	50000	NYSDEC TAGM	UG/KG	410	U	340	U
Carbazole			UG/KG	410	U	340	U
Chrysene	400	NYSDEC TAGM	UG/KG	36	J	28	J
Di-n-butylphthalate	8100	NYSDEC TAGM	UG/KG	35	J	340	U
Dibenz(a,h)anthracene	14	NYSDEC TAGM	UG/KG	410	U	340	U
Fluoranthene	50000	NYSDEC TAGM	UG/KG	71	J	41	J
Indeno(1,2,3-cd)pyrene	3200	NYSDEC TAGM	UG/KG	410	U	340	U

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-31
SEAD-17 Summary of Analytes Detected in Surface Soil

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS17-8		SS17-9	
			SAMP ID:	SS17-8-1		SS17-9-1	
			QC CODE:	SA		SA	
			STUDY ID:	ESI		ESI	
			TOP:	0		0	
			BOTTOM:	0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	10/21/93		10/20/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q
N-Nitrosodiphenylamine (1)			UG/KG	410	U	340	U
Naphthalene	13000	NYSDEC TAGM	UG/KG	410	U	340	U
Pentachlorophenol	1000	NYSDEC TAGM	UG/KG	1000	U	830	U
Phenanthrene	50000	NYSDEC TAGM	UG/KG	46	J	31	J
Pyrene	50000	NYSDEC TAGM	UG/KG	63	J	37	J
bis(2-Chloroisopropyl) ether			UG/KG				
bis(2-Ethylhexyl)phthalate	50000	NYSDEC TAGM	UG/KG	410	U	340	U
PESTICIDES/PCB							
4,4'-DDD	2900	NYSDEC TAGM	UG/KG	4.1	U	3.4	U
4,4'-DDE	2100	NYSDEC TAGM	UG/KG	3.4	J	8.8	
4,4'-DDT	2100	NYSDEC TAGM	UG/KG	4.1	U	3.4	U
Aldrin	41	NYSDEC TAGM	UG/KG	2.1	U	1.8	U
Aroclor-1260	1000	NYSDEC TAGM	UG/KG	41	U	34	U
Dieldrin	44	NYSDEC TAGM	UG/KG	4.1	U	3.4	U
Endosulfan I	900	NYSDEC TAGM	UG/KG	2.1	U	1.8	U
Endrin	100	NYSDEC TAGM	UG/KG	4.1	U	3.4	U
Heptachlor epoxide	20	NYSDEC TAGM	UG/KG	2.1	U	1.8	U
OTHER ANALYSES							
Nitrate/Nitrite-Nitrogen			MG/KG	0.08		3.5	
Percent Moisture (PEST/PCB)							
Percent Moisture (SVOCs)							
Percent Moisture (VOCs)							
Percent Solids (Metals)							
Total Organic Carbon			MG/KG				
NITROAROMATICS							

Note: Shaded values exceed the NYSDEC TAGM.

T. 4-31
SEAD-17 Summary of Analytes Detected in Surface Soil

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS17-8		SS17-9	
			SAMP ID:	SS17-8-1		SS17-9-1	
			QC CODE:	SA		SA	
			STUDY ID:	ESI		ESI	
			TOP:	0		0	
			BOTTOM:	0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	10/21/93		10/20/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q
2,4-Dinitrotoluene			UG/KG	130	U	130	U
METALS							
Aluminum	14592.8	NYSDEC TAGM	MG/KG	14300		3790	
Antimony	3.59	NYSDEC TAGM	MG/KG	7.4	JR	10.7	
Arsenic	7.5	NYSDEC TAGM	MG/KG	8.5		4.8	
Barium	300	NYSDEC TAGM	MG/KG	337	R	78.7	
Beryllium	0.73	NYSDEC TAGM	MG/KG	0.69		0.18	J
Cadmium	1	NYSDEC TAGM	MG/KG	5.1		6.3	
Calcium	101904	NYSDEC TAGM	MG/KG	110000		177000	
Chromium	22.13	NYSDEC TAGM	MG/KG	23.9		10	
Cobalt	30	NYSDEC TAGM	MG/KG	13.6		4.7	J
Copper	25	NYSDEC TAGM	MG/KG	654		136	
Cyanide	0.3	NYSDEC TAGM	MG/KG	0.59	U	0.59	U
Iron	26626.7	NYSDEC TAGM	MG/KG	27600		8020	
Lead	21.86	NYSDEC TAGM	MG/KG	2190		1340	
Magnesium	12221.8	NYSDEC TAGM	MG/KG	8380		17300	
Manganese	669.38	NYSDEC TAGM	MG/KG	590		270	J
Mercury	0.1	NYSDEC TAGM	MG/KG	0.09	J	0.04	J
Nickel	33.62	NYSDEC TAGM	MG/KG	43.7		16.4	
Potassium	1761.48	NYSDEC TAGM	MG/KG	1520		1110	
Selenium	2	NYSDEC TAGM	MG/KG	0.16	J	0.21	J
Silver	0.4	NYSDEC TAGM	MG/KG	4	J	5.5	
Sodium	103.74	NYSDEC TAGM	MG/KG	144	J	247	J
Thallium	0.28	NYSDEC TAGM	MG/KG	0.22	J	0.17	U
Vanadium	150	NYSDEC TAGM	MG/KG	22.2		8.9	

Note: **Shaded values exceed the** NYSDEC TAGM.
h:\eng\seneca\s1617ri\tables\s17ssclp.xls

T 4-31
SEAD-17 Summary of Analytes Detected in Surface Soil

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS17-8		SS17-9	
			SAMP ID:	SS17-8-1		SS17-9-1	
			QC CODE:	SA		SA	
			STUDY ID:	ESI		ESI	
			TOP:	0		0	
			BOTTOM:	0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	10/21/93		10/20/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q
Zinc	82.5	NYSDEC TAGM	MG/KG	**613**		**120**	
HERBICIDES							
MCPA			UG/KG	6200	U	5200	U

Note: **Shaded values exceed the** NYSDEC TAGM.
h:\eng\seneca\s1617ri\tables\s17ssclp.xls

Table 4-32

VOCs and TICs in Surface Soil (ug/Kg)

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Surface Soil Location	Surface Soil Sample ID	Study ID	Total TCL VOCs	Total TICs	Total All VOCs
SS17-1	SS17-1-1	ESI	0	19	19
SS17-2	SS17-2-1	ESI	0	67	67
SS17-3	SS17-3-1	ESI	0	16	16
SS17-4	SS17-4-1	ESI	0	0	0
SS17-5	SS17-5-1	ESI	0	0	0
SS17-6	SS17-6-1	ESI	0	0	0
SS17-7	SS17-7-1	ESI	0	0	0
SS17-8	SS17-8-1	ESI	0	7	7
SS17-9	SS17-9-1	ESI	4	0	4
SS17-10	SS17-10-1	ESI	0	45	45
SS17-11	SS17-11-1	ESI	0	23	23
SS17-12	SS17-12-1	ESI	0	0	0
SS17-13	SS17-13-1	ESI	12	0	12
SS17-14	SS17-14-1	ESI	0	0	0
SS17-15	SS17-15-1	ESI	0	0	0
SS17-16	SS17-16-1	ESI	0	0	0
SS17-17	SS17-17-1	ESI	0	0	0
SS17-18	SS17-18-1	ESI	0	0	0
SS17-18	SS17-24-1 (1)	ESI	15	0	15
SS17-19	SS17-19-1	ESI	0	983	983
SS17-20	SS17-20-1	ESI	0	0	0
SS17-21	SS17-21-1	ESI	0	0	0
SS17-22	SS17-22-1	ESI	0	107	107
SS17-23	SS17-23-1	ESI	0	0	0
SS17-24	16072	Round I	0	0	0
SS17-25	16073	Round I	0	0	0
SS17-26	16069	Round I	0	0	0
SS17-27	16063	Round I	0	0	0
SS17-28	16064	Round I	0	0	0
SS17-29	16065	Round I	10	7	17
SS17-30	16070	Round I	0	0	0
SS17-31	16071	Round I	8	6	14
SS17-34	16079	Round I	0	0	0
SS17-35	16078	Round I	0	0	0
SS17-36	16077	Round I	0	0	0
SS17-37	16080	Round I	0	0	0
SS17-38	16076	Round I	0	0	0
SS17-39	16075	Round I	0	0	0
500N	16081	Round I	0	0	0
1000S	16087	Round I	0	27230	27230
2000S	16085	Round I	0	0	0
3000S	16056	Round I	0	0	0
3500S	16055	Round I	2	23	25
500S	16082	Round I	0	0	0
1000N	16083	Round I	0	0	0
2000N	16089	Round I	0	19080	19080
2000N	16090 (2)	Round I	0	NA	NA
3000N	16088	Round I	0	17500	17500
3500N	16084	Round I	5	0	5

(1) Surface soil sample SS17-24 is a duplicate of SS17-18.
(2) Surface soil sample 16090 is a duplicate of 16089.
NA- Not Available

Table 4-33
SEAD_17 Summary of Analytes Detected in Subsurface Soil

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SB17-1		SB17-1		SB17-1		SB17-2		SB17-2		SB17-2		SB17-3	
			SAMP ID:	SB17-1-1		SB17-1-2		SB17-1-3		SB17-2-1		SB17-2-10		SB17-2-2		SB17-3-1	
			QC CODE:	SA		SA		SA		SA		DU		SA		SA	
			STUDY ID:	ESI		ESI		ESI		ESI		ESI		ESI		ESI	
			TOP:	0		2		4		0		2		2		0	
			BOTTOM:	2		4		6		2		4		4		2	
			MATRIX:	SOIL		SOIL		SOIL		SOIL		SOIL		SOIL		SOIL	
			SAMPLE DATE:	12/1/93		12/1/93		12/1/93		10/27/93		10/27/93		10/27/93		11/30/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
SEMIVOLATILE ORGANICS																	
bis(2-Ethylhexyl)phthalate	50000	NYSDEC TAGM	UG/KG	42	J	380	U	21	J	390	U	480		490		93	J
PESTICIDES/PCB																	
Aroclor-1254	10000	NYSDEC TAGM	UG/KG	42	U	61		36	U	39	U	38	U	38	U	40	U
OTHER ANALYSES																	
Nitrate/Nitrite-Nitrogen			MG/KG	0.15		0.33		0.24		0.51		0.01	U	0.05		0.22	
METALS																	
Aluminum	14592.8	NYSDEC TAGM	MG/KG	13700		**18100**		8700		**15900**		14100		**15600**		**19300**	
Arsenic	7.5	NYSDEC TAGM	MG/KG	4.3		5.2		3.4		5.2		6.3		6.9		4.1	
Barium	300	NYSDEC TAGM	MG/KG	107		114		59.4		158		71.4		68.5		104	
Beryllium	0.73	NYSDEC TAGM	MG/KG	0.7	J	**0.9**	**J**	0.42	J	0.62	J	0.58	J	0.56	J	**0.99**	
Cadmium	1	NYSDEC TAGM	MG/KG	0.73	U	0.74	U	0.56	U	**2.8**		0.6	U	0.74	U	0.43	U
Calcium	101904	NYSDEC TAGM	MG/KG	2870		20900		72800		48200		**115000**		44200		2620	
Chromium	22.13	NYSDEC TAGM	MG/KG	17.6		**25.1**		13.9		**27.1**		20.3		**23.3**		**27.9**	
Cobalt	30	NYSDEC TAGM	MG/KG	9.9	J	13.3		8.8		10.8	J	9.6		9.4	J	21.7	
Copper	25	NYSDEC TAGM	MG/KG	**46.4**		**26.9**		20		**85.1**		21.5		18.5		**25.9**	
Iron	26626.7	NYSDEC TAGM	MG/KG	25100		**29900**		18800		**38700**		24900		**26700**		**36100**	
Lead	21.86	NYSDEC TAGM	MG/KG	**266**		11.4	J	7.5	J	**686**		11.2		13		**24.6**	**J**
Magnesium	12221.8	NYSDEC TAGM	MG/KG	3330		8490		**18100**		6630		8370		8380		5820	
Manganese	669.38	NYSDEC TAGM	MG/KG	547		487		391		**673**		**1160**		409		**1080**	
Mercury	0.1	NYSDEC TAGM	MG/KG	0.05	J	0.06	J	0.03	UJ	0.04	U	0.04	J	0.04	J	0.06	J
Nickel	33.62	NYSDEC TAGM	MG/KG	19.1		**42**		25.2		**34.7**		27.4		30.8		**37.2**	
Potassium	1761.48	NYSDEC TAGM	MG/KG	628	J	1560		1090		1630		1750		1720		1540	

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-33
SEAD_17 Summary of Analytes Detected in Subsurface Soil

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SB17-1		SB17-1		SB17-1		SB17-2		SB17-2		SB17-2		SB17-3	
			SAMP ID:	SB17-1-1		SB17-1-2		SB17-1-3		SB17-2-1		SB17-2-10		SB17-2-2		SB17-3-1	
			QC CODE:	SA		SA		SA		SA		DU		SA		SA	
			STUDY ID:	ESI		ESI		ESI		ESI		ESI		ESI		ESI	
			TOP:	0		2		4		0		2		2		0	
			BOTTOM:	2		4		6		2		4		4		2	
			MATRIX:	SOIL		SOIL		SOIL		SOIL		SOIL		SOIL		SOIL	
			SAMPLE DATE:	12/1/93		12/1/93		12/1/93		10/27/93		10/27/93		10/27/93		11/30/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Sodium	103.74	NYSDEC TAGM	MG/KG	46.2	J	74.6	J	137	J	145	J	239	J	177	J	70.8	J
Vanadium	150	NYSDEC TAGM	MG/KG	23.1		27		13.9		27.3		21.8		23.9		30.7	
Zinc	82.5	NYSDEC TAGM	MG/KG	93.4		80.2		57.1		172		76.7		63		69.7	

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-33
SEAD_17 Summary of Analytes Detected in Subsurface Soil

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SB17-3		SB17-4		SB17-4	
			SAMP ID:	SB17-3-2		SB17-4-1		SB17-4-2	
			QC CODE:	SA		SA		SA	
			STUDY ID:	ESI		ESI		ESI	
			TOP:	2		0		2	
			BOTTOM:	4		2		4	
			MATRIX:	SOIL		SOIL		SOIL	
			SAMPLE DATE:	11/30/93		11/30/93		11/30/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q
SEMIVOLATILE ORGANICS									
bis(2-Ethylhexyl)phthalate	50000	NYSDEC TAGM	UG/KG	72	J	59	J	27	J
PESTICIDES/PCB									
Aroclor-1254	10000	NYSDEC TAGM	UG/KG	39	U	39	U	36	U
OTHER ANALYSES									
Nitrate/Nitrite-Nitrogen			MG/KG	0.19		0.41		0.22	
METALS									
Aluminum	14592.8	NYSDEC TAGM	MG/KG	13200		**15100**		11600	
Arsenic	7.5	NYSDEC TAGM	MG/KG	5.4		4.9		5.7	
Barium	300	NYSDEC TAGM	MG/KG	73.7		89.2		51.6	
Beryllium	0.73	NYSDEC TAGM	MG/KG	0.63	J	0.72		0.56	J
Cadmium	1	NYSDEC TAGM	MG/KG	0.74	U	0.43	U	0.38	U
Calcium	101904	NYSDEC TAGM	MG/KG	4920		3640		18100	
Chromium	22.13	NYSDEC TAGM	MG/KG	20.1		21.6		18.4	
Cobalt	30	NYSDEC TAGM	MG/KG	9	J	9.5		11	
Copper	25	NYSDEC TAGM	MG/KG	**26.9**		24		22.7	
Iron	26626.7	NYSDEC TAGM	MG/KG	25800		**27700**		25600	
Lead	21.86	NYSDEC TAGM	MG/KG	21.2	J	12	J	11.7	J
Magnesium	12221.8	NYSDEC TAGM	MG/KG	4600		5170		7890	
Manganese	669.38	NYSDEC TAGM	MG/KG	338		274		403	
Mercury	0.1	NYSDEC TAGM	MG/KG	0.04	J	0.04	U	0.03	J
Nickel	33.62	NYSDEC TAGM	MG/KG	31.5		28.6		30.8	
Potassium	1761.48	NYSDEC TAGM	MG/KG	1350		1220		960	

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-33
SEAD_17 Summary of Analytes Detected in Subsurface Soil

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SB17-3		SB17-4		SB17-4	
			SAMP ID:	SB17-3-2		SB17-4-1		SB17-4-2	
			QC CODE:	SA		SA		SA	
			STUDY ID:	ESI		ESI		ESI	
			TOP:	2		0		2	
			BOTTOM:	4		2		4	
			MATRIX:	SOIL		SOIL		SOIL	
			SAMPLE DATE:	11/30/93		11/30/93		11/30/93	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q
Sodium	103.74	NYSDEC TAGM	MG/KG	80.2	J	65.6	J	75.9	J
Vanadium	150	NYSDEC TAGM	MG/KG	21.1		26.1		18.6	
Zinc	82.5	NYSDEC TAGM	MG/KG	69		64.2		**85.1**	

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-34

VOCs and TICs in Subsurface Soil (ug/Kg)

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Soil Boring Location	Sample ID	Study ID	Total TCL TICs	Total TICs	Total All VOCs
SB17-1	SB17-1-1	ESI	0	0	0
SB17-1	SB17-1-2	ESI	0	0	0
SB17-1	SB17-1-3	ESI	0	0	0
SB17-2	SB17-2-1	ESI	0	7	7
SB17-2	SB17-2-2 (1)	ESI	0	0	0
SB17-2	SB17-2-10	ESI	0	0	0
SB17-3	SB17-3-1	ESI	0	0	0
SB17-3	SB17-3-2	ESI	0	0	0
SB17-4	SB17-4-1	ESI	0	0	0
SB17-4	SB17-4-2	ESI	0	0	0

(1) Soil boring sample SB17-2-10 is a duplicate sample of SB17-2-2.

Downwind Surface Soil Samples

A total of eleven downwind surface soil samples were collected as part of the RI field program for SEAD-17 (Table 4-35). The samples were collected along the two primary wind directions, i.e., north-northwest and south-southeast. Six samples were collected to the north-northwest and five samples were collected to the south-southeast.

The two VOC compounds, benzene and toluene, were detected in two downwind surface soil samples, however, both compounds were detected at concentrations far below their respective NYSDEC TAGM values. The two downwind surface soil samples were located 3500 feet north and south of the site.

4.2.2.2 Semivolatile Organic Compounds

Surface Soil

SVOCs were detected in nearly all of the 38 surface soil samples at SEAD-17, however, only the two compounds 3-nitroaniline and dibenz(a,h)anthrecene were detected at concentrations above their respective NYSDEC TAGM values (Table 4-31). 3-Nitroanaline exceeded the TAGM value of 500 µg/kg in only one sample. The concentration of 990 J µg/kg was detected in SS17-25. Dibenz(a,h)anthracene was detected in three samples with a maximum concentration of 59 µg/kg found in SS17-27. The TAGM value for this compound is 14 µg/kg.

PAH compounds were also detected, but at concentrations below their respective NYSDEC TAGM values. The highest concentration of carcinogenic PAH compounds was detected in the surface soil sample SS17-1 (426 µg/kg), which is located along the access road in the northeastern portion of the site. Figure 4-9 shows the distribution of total carcinogenic PAH compounds detected in surface soils.

The detection limits for dibenz(a,h)anthracene, benzo(a)pyrene, benzo(anthracene, and 3-nitroaniline exceeded the TAGM values of 14 µg/kg, 61 µg/kg, 224 µg/kg, and 500 µg/kg, respectively. Sample SS17-19 had elevated detection limits which exceeded the TAGM values for five additional compounds.

In addition to the NYSDEC TCL-listed SVOCs, TICs were estimated for the surface soil samples (Table 4-36). The highest concentration of total TICs (55,770 µg/kg) was found at SS17-25. This sample also contained the highest total SVOC concentration (60,041 µg/kg), which is the total of TCL-listed compounds and TICs. This concentration is below NYSDEC TAGM criteria value of 500,000 µg/kg for total SVOCs.

Subsurface Soil

The phthalate compound bis(2-ethylhexyl) phthalate was the only SVOC detected in the subsurface soil sample analyzed at SEAD-17. The maximum concentration of this compound was 490 µg/kg, which is well below the NYSDEC TAGM criteria of 50,000 µg/kg. This phthalate compound appears in laboratory blanks and is likely a laboratory contaminant. It is not believed to be representative of the soil chemistry at SEAD-17.

In addition to the NYSDEC TCL-listed SVOCs, TICs were quantified for the subsurface soil samples (Table 4-37). The highest concentration of TICs (7,110 µg/kg) was found in the 0-2 feet sample at SB17-1. This sample also contained the highest total SVOC concentration (7,152 µg/kg), which is below NYSDEC TAGM criteria value of 500,000 µg/kg for total SVOCs.

Detection limits for the compound bis(2-ethylhexyl)phthalate did not exceed the TAGM value.

Downwind Surface Soils

Twenty-three SVOCs, mostly PAH compounds, were detected in the downwind surface soil samples (Table 4-35). Six of the SVOCs were detected at concentrations exceeding their respective NYSDEC TAGM values. Five of the SVOCs were PAHs and one was a phenolic compound. Benzo(a)anthracene was detected in the two samples located 3500 feet north and south of the site at concentrations above the NYSDEC TAGM value of 224 µg/kg. The maximum concentration of 720 µg/kg was detected in sample 3500-N. Benzo(a)pyrene was detected in six samples at concentrations exceeding the NYSDEC TAGM value. The two maximum concentrations of 940 µg/kg and 640 µg/kg were detected in the two samples located 3500 feet north and south of the site. Benzo(b)fluoranthene was found in only one sample, 3500-N, at a concentration above the TAGM value. Chrysene was found in two samples at concentrations above the NYSDEC TAGM value. Both exceedences were found in samples 3500-N and 3500-S. Dibenz(a,h)anthracene was detected in seven samples at concentrations above the TAGM value. The two maximum concentrations of 470 µg/kg and 200 J µg/kg were detected in samples 3500-N and 3000-S. The maximum total carcinogenic PAH concentrations were 5,790 µg/kg and 2,360 µg/kg, which were found in samples 3500-N and 3500-S, respectively.

Table 4-35
SEAD-17 Summary of Analytes Detected in Downwind Surface Soil
SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS17-500-N		SS17-500-S		1000-N		1000-S		2000-N		2000-N	
			SAMP ID:	16081		16082		16083		16087		16089		16090	
			QC CODE:	SA		SA		SA		SA		SA		DU	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/22/96		8/22/96		8/22/96		8/22/96		8/22/96		8/22/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
VOLATILE ORGANICS															
Benzene	60	NYSDEC TAGM	UG/KG	13	U	12	U	11	UJ	12	U	12	U	12	U
Toluene	1500	NYSDEC TAGM	UG/KG	13	UJ	12	U	11	UJ	12	U	12	U	12	U
SEMIVOLATILE ORGANICS															
2,4-Dinitrotoluene			UG/KG	420	U	400	U	370	U	380	U	390	U	390	U
2-Methylnaphthalene	36400	NYSDEC TAGM	UG/KG	420	U	400	U	370	U	380	U	390	U	390	U
2-Methylphenol	100	NYSDEC TAGM	UG/KG	420	U	400	U	370	U	380	U	390	U	390	U
Acenaphthene	50000	NYSDEC TAGM	UG/KG	420	U	400	U	370	U	18	J	390	U	390	U
Acenaphthylene	41000	NYSDEC TAGM	UG/KG	420	U	400	U	370	U	380	U	390	U	390	U
Anthracene	50000	NYSDEC TAGM	UG/KG	420	U	400	U	370	U	380	U	390	U	390	U
Benzo(a)anthracene	224	NYSDEC TAGM	UG/KG	420	U	400	U	39	J	85	J	57	J	52	J
Benzo(a)pyrene	61	NYSDEC TAGM	UG/KG	420	U	20	J	39	J	110	J	69	J	62	J
Benzo(b)fluoranthene	1100	NYSDEC TAGM	UG/KG	420	U	400	U	42	J	120	J	68	J	54	J
Benzo(g,h,i)perylene	50000	NYSDEC TAGM	UG/KG	420	U	400	U	35	J	130	J	65	J	55	J
Benzo(k)fluoranthene	1100	NYSDEC TAGM	UG/KG	420	U	400	U	47	J	94	J	65	J	61	J
Carbazole			UG/KG	420	UJ	400	UJ	370	UJ	380	U	390	U	390	U
Chrysene	400	NYSDEC TAGM	UG/KG	420	U	400	U	55	J	110	J	70	J	62	J
Di-n-butylphthalate	8100	NYSDEC TAGM	UG/KG	420	UJ	400	U	370	U	380	U	390	U	390	U
Dibenz(a,h)anthracene	14	NYSDEC TAGM	UG/KG	420	U	400	U	370	U	54	J	34	J	30	J
Dibenzofuran	6200	NYSDEC TAGM	UG/KG	420	U	400	U	370	U	380	U	390	U	390	U
Fluoranthene	50000	NYSDEC TAGM	UG/KG	26	J	28	J	70	J	160	J	110	J	93	J
Fluorene	50000	NYSDEC TAGM	UG/KG	420	U	400	U	370	U	380	U	390	U	390	U

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-35
SEAD-17 Summary of Analytes Detected in Downwind Surface Soil
SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS17-500-N		SS17-500-S		1000-N		1000-S		2000-N		2000-N	
			SAMP ID:	16081		16082		16083		16087		16089		16090	
			QC CODE:	SA		SA		SA		SA		SA		DU	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/22/96		8/22/96		8/22/96		8/22/96		8/22/96		8/22/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Indeno(1,2,3-cd)pyrene	3200	NYSDEC TAGM	UG/KG	420	U	400	U	32	J	110	J	55	J	50	J
N-Nitrosodiphenylamine (1)			UG/KG	420	U	400	U	370	U	380	U	390	U	390	U
Naphthalene	13000	NYSDEC TAGM	UG/KG	420	U	400	U	370	U	380	U	390	U	390	U
Phenanthrene	50000	NYSDEC TAGM	UG/KG	420	U	400	U	34	J	90	J	36	J	35	J
Pyrene	50000	NYSDEC TAGM	UG/KG	30	J	36	J	76	J	160	J	92	J	81	J
PESTICIDES/PCB															
4,4'-DDE	2100	NYSDEC TAGM	UG/KG	4.2	U	4	U	5.2	J	1.9	J	3.9	U	3.9	U
4,4'-DDT	2100	NYSDEC TAGM	UG/KG	4.2	U	4	U	6	J	3.8	U	3.9	U	3.9	U
Dieldrin	44	NYSDEC TAGM	UG/KG	4.2	U	4	U	3.7	U	3.8	U	3.9	U	3.9	U
Endosulfan I	900	NYSDEC TAGM	UG/KG	2.2	U	2.1	U	1.6	J	2	U	2	U	2	U
Endosulfan sulfate	1000	NYSDEC TAGM	UG/KG	2.2	U	4	U	3.7	U	3.8	U	3.9	U	3.9	U
Endrin	100	NYSDEC TAGM	UG/KG	4.2	U	4	U	3.7	U	3.8	U	3.9	U	3.9	U
Endrin ketone			UG/KG	2.2	U	2.1	U	3.7	U	3.8	U	3.9	U	3.9	U
alpha-Chlordane			UG/KG	4.2	U	4	U	1.1	J	2	U	2	U	2	U
beta-BHC	200	NYSDEC TAGM	UG/KG	2.2	U	2.1	U	1.9	U	2	U	2	U	2	U
delta-BHC	300	NYSDEC TAGM	UG/KG	2.2	U	2.1	U	2.2		2	U	2	U	2	U
OTHER ANALYSES															
Nitrate/Nitrite-Nitrogen			MG/KG	0.23		0.5		0.34		0.27		6.1		6	
Percent Moisture (PEST/PCB)				21		18		11		14		16		16	
Percent Moisture (SVOCs)				21		18		11		14		16		16	
Percent Moisture (VOCs)				22		18		11		14		17		17	
Percent Solids (Metals)				79.2		82.4		88.7		86.1		83.5		83.6	

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-35
SEAD-17 Summary of Analytes Detected in Downwind Surface Soil
SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS17-500-N		SS17-500-S		1000-N		1000-S		2000-N		2000-N	
			SAMP ID:	16081		16082		16083		16087		16089		16090	
			QC CODE:	SA		SA		SA		SA		SA		DU	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/22/96		8/22/96		8/22/96		8/22/96		8/22/96		8/22/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
NITROAROMATICS															
2,6-Dinitrotoluene	1000	NYSDEC TAGM	UG/KG	120	U	120	U	120	U	120	UJ	120	UJ	120	UJ
METALS															
Aluminum	14592.8	NYSDEC TAGM	MG/KG	**14600**	J	13300	J	13900	J	11600	J	11700	J	11500	J
Antimony	3.59	NYSDEC TAGM	MG/KG	0.5		1.2		0.7		0.8	J	0.39	U	0.45	U
Arsenic	7.5	NYSDEC TAGM	MG/KG	5.2		4.1		4.9		4.5	J	4.6	J	4.5	J
Barium	300	NYSDEC TAGM	MG/KG	117	J	79.9	J	81.8	J	90.3	J	113	J	109	J
Beryllium	0.73	NYSDEC TAGM	MG/KG	0.62		0.51		0.54		0.48		0.41		0.44	
Cadmium	1	NYSDEC TAGM	MG/KG	0.2		0.37		0.07		0.34		0.21		0.21	
Calcium	101904	NYSDEC TAGM	MG/KG	4570		3140		9650		14500		3410		3420	
Chromium	22.13	NYSDEC TAGM	MG/KG	20.3		17.2		**24.4**		18.5		14.8		14.8	
Cobalt	30	NYSDEC TAGM	MG/KG	8.9		6.3		15.7		9.2		7.2		7.1	
Copper	25	NYSDEC TAGM	MG/KG	24.3		19.3		**39**		21.2		17.9		17.7	
Iron	26626.7	NYSDEC TAGM	MG/KG	23200		19300		**29300**		22500		19100		19100	
Lead	21.86	NYSDEC TAGM	MG/KG	**47.7**		**80.8**		**52**		**58**		19.7		19.5	
Magnesium	12221.8	NYSDEC TAGM	MG/KG	3610		3130		6120		5330		3230		3200	
Manganese	669.38	NYSDEC TAGM	MG/KG	550	J	234	J	399	J	452		663		587	
Mercury	0.1	NYSDEC TAGM	MG/KG	0.09		0.07		0.06		0.06		0.07		0.09	
Nickel	33.62	NYSDEC TAGM	MG/KG	24.1		17.8		**50.8**		26.4		16.6		16.4	
Potassium	1761.48	NYSDEC TAGM	MG/KG	**1870**		1150		1460		1100		1030		1060	
Selenium	2	NYSDEC TAGM	MG/KG	1.1	J	1.4	J	1.3	J	1.4		1.3		1.5	
Sodium	103.74	NYSDEC TAGM	MG/KG	66.3	U	66.8		0.88	U	59.2	U	51.7	U	59.9	U

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-35
SEAD-17 Summary of Analytes Detected in Downwind Surface Soil
SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SS17-500-N		SS17-500-S		1000-N		1000-S		2000-N		2000-N	
			SAMP ID:	16081		16082		16083		16087		16089		16090	
			QC CODE:	SA		SA		SA		SA		SA		DU	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/22/96		8/22/96		8/22/96		8/22/96		8/22/96		8/22/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Thallium	0.28	NYSDEC TAGM	MG/KG	1.1		0.96	U	20.5		0.93	U	0.81	U	0.94	U
Vanadium	150	NYSDEC TAGM	MG/KG	25.8		22.9		109	J	19		19.4		19.5	
Zinc	82.5	NYSDEC TAGM	MG/KG	84.2	J	82.5	J			92.5		55.8		55.8	

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-35
SEAD-17 Summary of Analytes Detected in Downwind Surface Soil
SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	2000-S		3000-N		3000-S		3500-N		3500-S	
			SAMP ID:	16085		16088		16056		16084		16055	
			QC CODE:	SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/22/96		8/22/96		8/20/96		8/22/96		8/20/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
VOLATILE ORGANICS													
Benzene	60	NYSDEC TAGM	UG/KG	12	U	12	U	11	U	2	J	11	U
Toluene	1500	NYSDEC TAGM	UG/KG	12	U	12	U	11	U	3	J	2	J
SEMIVOLATILE ORGANICS													
2,4-Dinitrotoluene			UG/KG	410	U	380	U	380	U	880		400	
2-Methylnaphthalene	36400	NYSDEC TAGM	UG/KG	410	U	380	U	380	U	340	U	28	J
2-Methylphenol	100	NYSDEC TAGM	UG/KG	**120**	**J**	380	U	380	U	340	U	350	U
Acenaphthene	50000	NYSDEC TAGM	UG/KG	410	U	380	U	380	U	340	U	33	J
Acenaphthylene	41000	NYSDEC TAGM	UG/KG	410	U	380	U	380	U	96	J	35	J
Anthracene	50000	NYSDEC TAGM	UG/KG	410	U	380	U	380	U	110	J	130	J
Benzo(a)anthracene	224	NYSDEC TAGM	UG/KG	19	J	54	J	380	U	**720**		**480**	
Benzo(a)pyrene	61	NYSDEC TAGM	UG/KG	22	J	**73**	**J**	380	U	**940**		**640**	
Benzo(b)fluoranthene	1100	NYSDEC TAGM	UG/KG	410	U	58	J	380	U	**2200**	**J**	580	
Benzo(g,h,i)perylene	50000	NYSDEC TAGM	UG/KG	51	J	78	J	380	U	710		540	
Benzo(k)fluoranthene	1100	NYSDEC TAGM	UG/KG	38	J	73	J	380	U	340	U	530	
Carbazole			UG/KG	410	UJ	380	U	380	U	85	J	40	J
Chrysene	400	NYSDEC TAGM	UG/KG	25	J	69	J	380	U	**670**		**520**	
Di-n-butylphthalate	8100	NYSDEC TAGM	UG/KG	410	U	380	U	380	U	340	U	90	J
Dibenz(a,h)anthracene	14	NYSDEC TAGM	UG/KG	410	U	**39**	**J**	**18**	**J**	**470**		**200**	**J**
Dibenzofuran	6200	NYSDEC TAGM	UG/KG	410	U	380	U	380	U	340	U	36	J
Fluoranthene	50000	NYSDEC TAGM	UG/KG	36	J	100	J	380	U	1000		780	
Fluorene	50000	NYSDEC TAGM	UG/KG	410	U	380	U	380	U	340	U	38	J

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-35
SEAD-17 Summary of Analytes Detected in Downwind Surface Soil
SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	2000-S		3000-N		3000-S		3500-N		3500-S	
			SAMP ID:	16085		16088		16056		16084		16055	
			QC CODE:	SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/22/96		8/22/96		8/20/96		8/22/96		8/20/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Indeno(1,2,3-cd)pyrene	3200	NYSDEC TAGM	UG/KG	20	J	70	J	380	U	790		520	
N-Nitrosodiphenylamine (1)			UG/KG	410	U	380	U	380	U	95	J	47	J
Naphthalene	13000	NYSDEC TAGM	UG/KG	410	U	380	U	380	U	16	J	29	J
Phenanthrene	50000	NYSDEC TAGM	UG/KG	410	U	42	J	380	U	320	J	360	
Pyrene	50000	NYSDEC TAGM	UG/KG	38	J	90	J	380	U	1200		620	
PESTICIDES/PCB													
4,4'-DDE	2100	NYSDEC TAGM	UG/KG	4.1	U	3.8	U	3.7	U	8.9		140	J
4,4'-DDT	2100	NYSDEC TAGM	UG/KG	4.1	U	3.8	U	3.7	U	13	J	35	U
Dieldrin	44	NYSDEC TAGM	UG/KG	4.1	U	8.4	J	3.5	UJ	3.4	U	17	U
Endosulfan I	900	NYSDEC TAGM	UG/KG	2.1	U	2	U	1.9	U	12	J	430	J
Endosulfan sulfate	1000	NYSDEC TAGM	UG/KG	4.1	U	3.8	U	3.7	U	3.4	U	20	J
Endrin	100	NYSDEC TAGM	UG/KG	4.1	U	3.8	U	3.7	U	5.6		43	
Endrin ketone			UG/KG	4.1	U	3.8	U	3.7	U	4.8		71	
alpha-Chlordane			UG/KG	2.1	U	2	U	1.9	U	1.8	U	11	R
beta-BHC	200	NYSDEC TAGM	UG/KG	2.1	U	2	U	1.9	U	1.8	U	20	J
delta-BHC	300	NYSDEC TAGM	UG/KG	2.1	U	2	U	1.9	U	1.8	U	18	U
OTHER ANALYSES													
Nitrate/Nitrite-Nitrogen			MG/KG	0.27		0.64		0.06		0.34		0.44	
Percent Moisture (PEST/PCB)				19		14		12		3		6	
Percent Moisture (SVOCs)				19		14		12		3		6	
Percent Moisture (VOCs)				20		18		11		3		8	
Percent Solids (Metals)				81.4		85.7		87.9		97.2		93.7	

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-35
SEAD-17 Summary of Analytes Detected in Downwind Surface Soil
SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	2000-S		3000-N		3000-S		3500-N		3500-S	
			SAMP ID:	16085		16088		16056		16084		16055	
			QC CODE:	SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/22/96		8/22/96		8/20/96		8/22/96		8/20/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
NITROAROMATICS													
2,6-Dinitrotoluene	1000	NYSDEC TAGM	UG/KG	120	U	120	UJ	120	U	120	U	900	J
METALS													
Aluminum	14592.8	NYSDEC TAGM	MG/KG	14100	J	12700	J	11800	J	4120	J	8620	J
Antimony	3.59	NYSDEC TAGM	MG/KG	0.36		0.7	J	0.37	UJ	0.56		0.74	J
Arsenic	7.5	NYSDEC TAGM	MG/KG	5.1		5.1	J	5.6		3.8		4.5	
Barium	300	NYSDEC TAGM	MG/KG	129	J	98.7	J	69.1	J	27.2	J	86.4	J
Beryllium	0.73	NYSDEC TAGM	MG/KG	0.57		0.43		0.51		0.16		0.32	
Cadmium	1	NYSDEC TAGM	MG/KG	0.21		0.1		0.18		0.23		0.32	
Calcium	101904	NYSDEC TAGM	MG/KG	3600		18200		10800		**229000**		**107000**	
Chromium	22.13	NYSDEC TAGM	MG/KG	19.5		18.4		19.9		9.3		14	
Cobalt	30	NYSDEC TAGM	MG/KG	10.7		10.3		12.3		4.7		6.8	
Copper	25	NYSDEC TAGM	MG/KG	19.9		20.4		**28.9**		14.9		**29.6**	
Iron	26626.7	NYSDEC TAGM	MG/KG	24000		23600		24900		9760		15800	J
Lead	21.86	NYSDEC TAGM	MG/KG	**29**		19.3		16.7		**36.7**		**36**	
Magnesium	12221.8	NYSDEC TAGM	MG/KG	3840		6820		5330		8430		6310	
Manganese	669.38	NYSDEC TAGM	MG/KG	**704**	**J**	**670**		550		286	J	558	
Mercury	0.1	NYSDEC TAGM	MG/KG	0.06		**0.56**		0.05		0.04	U	0.05	
Nickel	33.62	NYSDEC TAGM	MG/KG	25.9		27.2		**34.6**		15.8		18.1	
Potassium	1761.48	NYSDEC TAGM	MG/KG	1730		1420		1320		848		1410	
Selenium	2	NYSDEC TAGM	MG/KG	1.4	J	1.2		0.74		0.5	J	1.2	
Sodium	103.74	NYSDEC TAGM	MG/KG	49.4		57.9	U	49.5	U	**383**		68.9	

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-35
SEAD-17 Summary of Analytes Detected in Downwind Surface Soil
SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	2000-S		3000-N		3000-S		3500-N		3500-S	
			SAMP ID:	16085		16088		16056		16084		16055	
			QC CODE:	SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0	
			BOTTOM:	0.2		0.2		0.2		0.2		0.2	
			MATRIX:	SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL		SURFACE SOIL	
			SAMPLE DATE:	8/22/96		8/22/96		8/20/96		8/22/96		8/20/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Thallium	0.28	NYSDEC TAGM	MG/KG	**0.83**		0.91	U	**1.2**		0.74	U	**1**	
Vanadium	150	NYSDEC TAGM	MG/KG	22.3		20.1		19		15.5		19.8	
Zinc	82.5	NYSDEC TAGM	MG/KG	78.7	J	68.2		**97.9**		53.2	J	**90.8**	

Note: Shaded values exceed the NYSDEC TAGM.

Table 4-36

SVOCs and TICs in Surface Soil (ug/Kg)

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Surface Soil Location	Surface Soil Sample ID	Study ID	Total TCL SVOCs	Total TICs	Total All SVOCs
SS17-1	SS17-1-1	ESI	1573	34920	36493
SS17-2	SS17-2-1	ESI	665	21050	21715
SS17-3	SS17-3-1	ESI	335	13880	14215
SS17-4	SS17-4-1	ESI	2217	18730	20947
SS17-5	SS17-5-1	ESI	775	18190	18965
SS17-6	SS17-6-1	ESI	318	1746	2064
SS17-7	SS17-7-1	ESI	768	11680	12448
SS17-8	SS17-8-1	ESI	355	7510	7865
SS17-9	SS17-9-1	ESI	187	2206	2393
SS17-10	SS17-10-1	ESI	775	3790	4565
SS17-11	SS17-11-1	ESI	1392	8510	9902
SS17-12	SS17-12-1	ESI	210	1870	2080
SS17-13	SS17-13-1	ESI	536	1210	1746
SS17-14	SS17-14-1	ESI	50	481	531
SS17-15	SS17-15-1	ESI	0	1374	1374
SS17-16	SS17-16-1	ESI	399	18800	19199
SS17-17	SS17-17-1	ESI	23	12310	12333
SS17-18	SS18-18-1	ESI	2215	15680	17895
SS17-18	SS17-24-1 (1)	ESI	1518	4804	6322
SS17-19	SS17-19-1	ESI	1200	66620	67820
SS17-20	SS17-20-2	ESI	510	12390	12900
SS17-21	SS17-21-1	ESI	960	17300	18260
SS17-22	SS17-22-1	ESI	228	4371	4599
SS17-23	SS17-23-1	ESI	0	5493	5493
SS17-24	16072	Round I	1044	13810	14854
SS17-25	16073	Round I	4271	55770	60041
SS17-26	16069	Round I	226	18210	18436
SS17-27	16063	Round I	59	22190	22249
SS17-28	16064	Round I	55	14780	14835
SS17-29	16065	Round I	167	5670	5837
SS17-30	16070	Round I	213	10790	11003
SS17-31	16071	Round I	117	20490	20607
SS17-34	16079	Round I	74	14480	14554
SS17-35	16078	Round I	99	24150	24249
SS17-36	16077	Round I	0	13290	13290
SS17-37	16080	Round I	1229	23350	24579
SS17-38	16076	Round I	93	13820	13913
SS17-39	16075	Round I	126	19150	19276
500N	16081	Round I	56	15810	15866
1000S	16087	Round I	1241	27230	28471
2000S	16085	Round I	369	9810	10179
3000S	16056	Round I	18	13070	13088
3500S	16055	Round I	6676	11830	18506
500S	16082	Round I	84	16490	16574
1000N	16083	Round I	469	17500	17969
2000N	16089	Round I	721	19080	19801
2000N	16090 (2)	Round I	635	NA	NA
3000N	16088	Round I	746	17500	18246
3500N	16084	Round I	10302	8180	18482

(1) Surface soil sample SS17-24-1 is a duplicate of SS17-18-1.
(2) Surface soil sample 16090 is a duplicate of 16089.
NA- Not Available

Table 4-37

SVOCs and TICs in Subsurface Soil (ug/Kg)

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Soil Boring Location	Sample ID	Study ID	Total SVOC TICs	Total TICs	Total All SVOCs
SB17-1	SB17-1-1	ESI	42	7110	7152
SB17-1	SB17-1-2	ESI	0	1366	1366
SB17-1	SB17-1-3	ESI	21	1432	1453
SB17-2	SB17-2-1	ESI	0	1920	1920
SB17-2	SB17-2-2	ESI	490	523	1013
SB17-2	SB17-2-10 (1)	ESI	480	290	770
SB17-3	SB17-3-1	ESI	93	2915	3008
SB17-3	SB17-3-2	ESI	72	2204	2276
SB17-4	SB17-4-1	ESI	59	3454	3513
SB17-4	SB17-4-2	ESI	27	3672	3699

(1) Soil boring sample SB17-2-10 is a duplicate sample of SB17-2-2.

4.2.2.3 Pesticide and PCBs

Surface Soils

Nine pesticides were detected in the 38 surface soil samples from SEAD-17. In all, pesticides were found in 23 of the 38 surface soil samples (Table 4-31). The compound dieldrin, which was the only pesticide detected at concentrations above the NYSDEC TAGM value, was detected in two samples above the TAGM value of 44 µg/kg. Concentrations of 80 J µg/kg and 62 J µg/kg were detected in SS17-28 and SS17-11, respectively.

One PCB, Aroclor-1260, was detected in three samples at concentrations well below the NYSDEC TAGM value of 1,000 ug/kg.

Detection limits for pesticides and PCBs did not exceed the TAGM values.

Subsurface Soils

No pesticides were detected in the subsurface soil samples analyzed at SEAD-17. Aroclor-1254 was the only PCB compound which was detected in one soil sample at a concentration of 61 µg/kg. The NYSDEC TAGM criteria for Aroclor-1254 is 1,000 µg/kg.

Detection limits for the compound Aroclor-1254 did not exceed the TAGM value.

Downwind Surface Soils

A total of ten pesticides were detected in the downwind surface soil samples, however, all the pesticides were detected at concentrations below their respective NYSDEC TAGM values.

4.2.2.4 Nitroaromatics

Surface Soils

One nitroaromatic compound, 2,4-dinitrotoluene, was detected in four surface soil samples collected at SEAD-17 (Table 4-31). This compound was identified in surface soil samples SS17-6 (170 µg/kg) , SS17-10 (330 J µg/kg), and SS17-13 (130 µg/kg), and SS17-18 (72 J µg/kg). This compound does not have a NYSDEC TAGM criteria value.

Subsurface Soils

No nitroaromatics were detected in the subsurface soil samples collected at SEAD-17.

Downwind Surface Soils

One nitroaromatic compound was detected in the downwind surface soil samples. The compound, 2,6-dinitrotoluene, was detected in only one sample, 3500-S, at a concentration of 900 J µg/kg, which is below the NYSDEC TAGM value. Sample 3500-S was collected at a location 3,500 feet south-southeast of the site.

4.2.2.5 Herbicides

Surface Soils

Twenty-four surface soil samples were collected during the ESI and analyzed for herbicides; none were collected during the RI for analysis of herbicides (Table 4-31). Based on these results, only one herbicide, MCPA, was detected at SEAD-17; the compound does not have a NYSDEC TAGM value.

Subsurface Soils

No herbicides were detected in the subsurface soil samples analyzed at SEAD-17.

Downwind Surface Soils

Herbicides were not collected for analysis in the downwind surface soil samples.

4.2.2.6 Metals

Surface Soils

Metals were detected in all 38 surface soil sample locations at the site (Table 4-31). Twenty-one metals were found at concentrations that exceeded their respective NYSDEC TAGM values. The metals that exceeded the standards are as follows: aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, copper, cyanide, iron, lead, magnesium, manganese, mercury, nickel, potassium, silver, sodium, thallium, and zinc. While all of the metals can occur naturally in soil, several of them are more common constituents of soil (i.e., aluminum, calcium, iron, magnesium, manganese, potassium and sodium) and are generally considered to be less problematic than the others listed. The remaining metals (i.e., antimony, arsenic, barium, beryllium, cadmium, chromium, copper, cyanide, lead, mercury, nickel, silver, thallium, and zinc) are a concern at elevated concentrations since they are generally considered to be more toxic and, therefore, are more pertinent to a discussion of significant impacts at the site.

Antimony was detected in nine of the 38 surface soil samples at concentrations above the TAGM value and antimony's maximum concentration of 52 J mg/kg was detected in SS17-10. Figure 4-10 shows the distribution of antimony in surface soils. Arsenic was detected in eight of the 38 surface samples at concentrations above the TAGM value; its maximum concentration (16.1 mg/kg) exceeded the TAGM value of 7.5 mg/kg. Barium was detected in five samples slightly above the TAGM value of 300 mg/kg and its maximum concentration of 524 J mg/kg was detected in SS17-37. Beryllium only slightly exceeded the TAGM value of 0.73 mg/kg in 10 samples; the maximum concentration (0.87 mg/kg) was only 1.2 times the TAGM value. Cadmium was detected in 28 of the samples at concentrations above the TAGM value. The maximum concentration of cadmium (25.5 mg/kg) was detected in SS17-37. Chromium, which was found above the TAGM in 16 samples, was detected at maximum concentration of 27.2 mg/kg, which is 1.2 times the TAGM value. Copper was detected above its TAGM value in 37 samples. The sample from SS17-37 contained a maximum copper concentration of 837 mg/kg, which exceeds the TAGM value of 25 mg/kg. Figure 4-11 shows the distribution of copper in surface soils. Cyanide was detected in only two samples, however, both concentrations were above the TAGM value of 0.30 mg/kg. Cyanide concentrations of 1.5 mg/kg and 0.78 mg/kg were detected in SS17-34 and SS17-35, respectively. Lead was detected in 37 surface soil samples at concentrations above the TAGM value. Sample SS17-37, which is located south of Building 367, contained the maximum concentration of lead (6,270 mg/kg). Figure 4-12 shows the distribution of lead in surface soils. Mercury was detected in seven of the 38 samples at concentrations above the TAGM value, and the maximum concentration (1.0 mg/kg at SS17-2) exceeded the TAGM value by 10 times. Silver was detected in 17 samples at concentrations above the TAGM value. Silver's maximum concentration of 9 mg/kg was found in sample SS17-37. Thallium was detected above the TAGM value in six of the samples. The maximum concentration of thallium of 1.5 mg/kg was detected in surface soil samples SS17-24 and SS17-26. Zinc was detected in 35 of the 38 samples at concentrations above the TAGM value. The maximum concentration of 1,530 mg/kg was found in SS17-18; it is noteworthy that this location is at the outfall of a pipe that drains from the retort inside Building 367. Figure 4-13 shows the distribution of zinc in surface soils.

For the metals cyanide and thallium, the detection limits exceeded the respective TAGM values.

Subsurface Soils

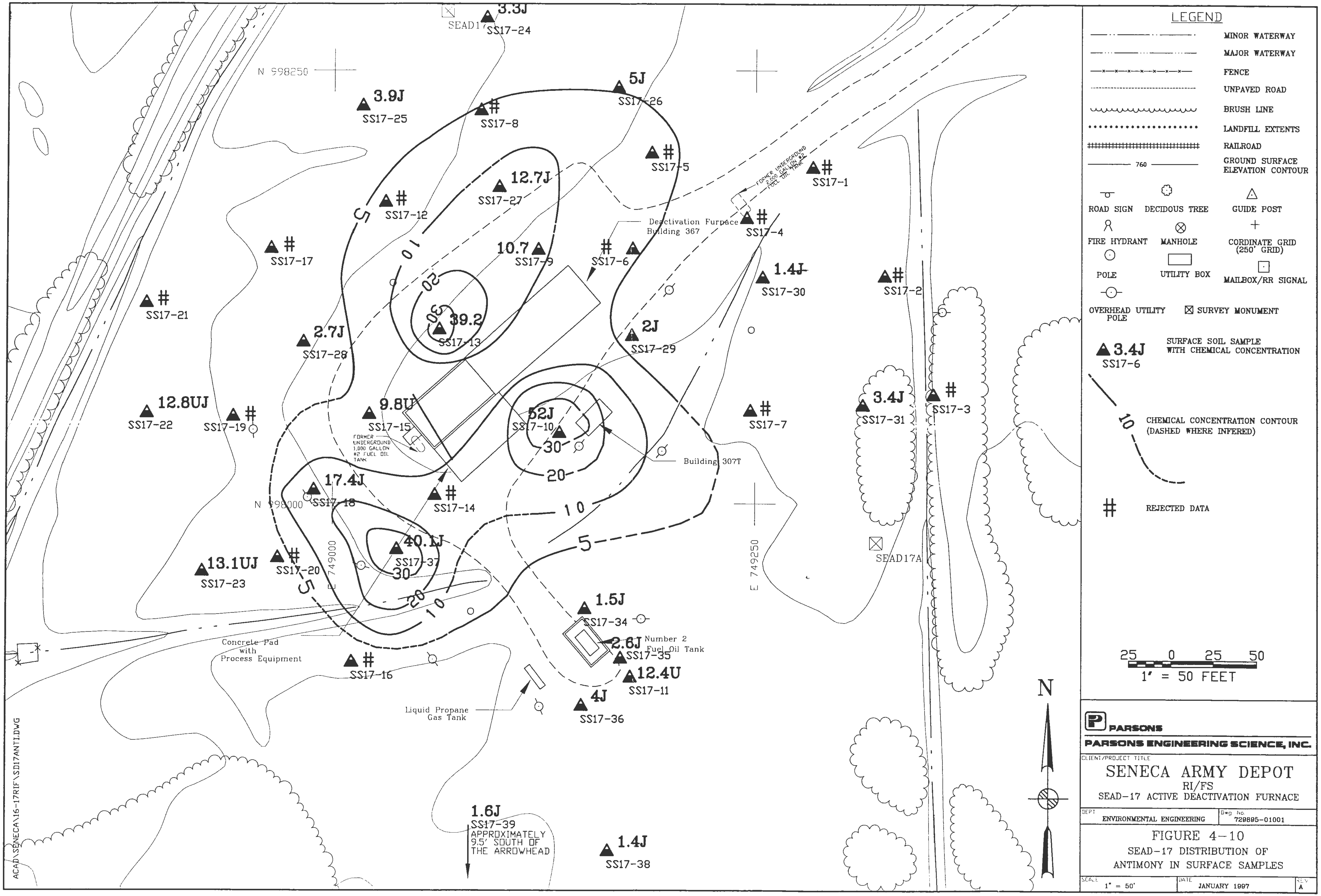
Metals were detected in all ten subsurface soil samples collected at the site (Table 4-33). Thirteen metals were found at concentrations that exceeded their respective NYSDEC TAGM values. The metals that exceeded the standards are as follows: aluminum, beryllium, cadmium, calcium, chromium, copper, iron, lead, magnesium, manganese, nickel, sodium, and zinc. While all of the metals can occur naturally in soil, several of them are more common constituents of soil (i.e., aluminum, calcium, iron, magnesium, manganese, and sodium) and are generally considered to be less problematic than the others listed. The remaining metals (i.e., beryllium, cadmium, chromium, copper, lead, nickel, and zinc) are a concern at elevated concentrations since they are generally considered to be more toxic and, therefore, are more pertinent to a discussion of significant impacts at the site.

Beryllium exceeded the TAGM value of 0.73 mg/kg in only two samples. The exceedences were only slightly above the TAGM value. Cadmium was detected in only one sample above the TAGM value. The concentration of cadmium in sample SB17-2 (2.8 mg/kg) exceeded the TAGM value of 1 mg/kg. Chromium was detected in four samples at concentrations above the NYSDEC TAGM value. The exceedences for this metal were also only slightly above the TAGM value of 22 mg/kg. Copper was detected in five samples at concentrations exceeding the NYSDEC TAGM value of 25 mg/kg. The maximum concentration of copper (85.1 mg/kg) was detected in SB17-2 (0-2 feet). Lead was detected in ten samples and the two highest concentrations of lead were found in samples collected from 0-2 feet in SB17-1 and 0-2 feet in soil boring SB17-2. The sample from SB17-1 contained 266 mg/kg of lead (10 times the TAGM value) and the sample from SB17-2 contained 686 mg/kg (31.2 times the TAGM value). Nickel was found in three samples at concentrations that were above the TAGM value of 33.6 mg/kg. Its maximum concentration of 42.0 mg/kg was detected in SB17-1 from 2-4 feet. Zinc was detected in three samples above the TAGM value. The maximum zinc concentration of 172 mg/kg was found in SB17-2 from 0-2 feet.

No detection limits for metals exceeded the respective TAGM values.

Downwind Surface Soils

Metals were detected in all ten of the downwind surface soil samples collected for SEAD-17 (Table 4-35). Thirteen metals were found at concentrations that exceeded their respective NYSDEC TAGM values. These metals are aluminum, calcium, chromium, copper, iron, lead, manganese, mercury, nickel, potassium, sodium, thallium, and zinc. Of these metals, chromium, copper, lead, mercury, nickel, thallium, and zinc are considered to be more toxic and will be discussed below.



PARSONS

PARSONS ENGINEERING SCIENCE, INC.

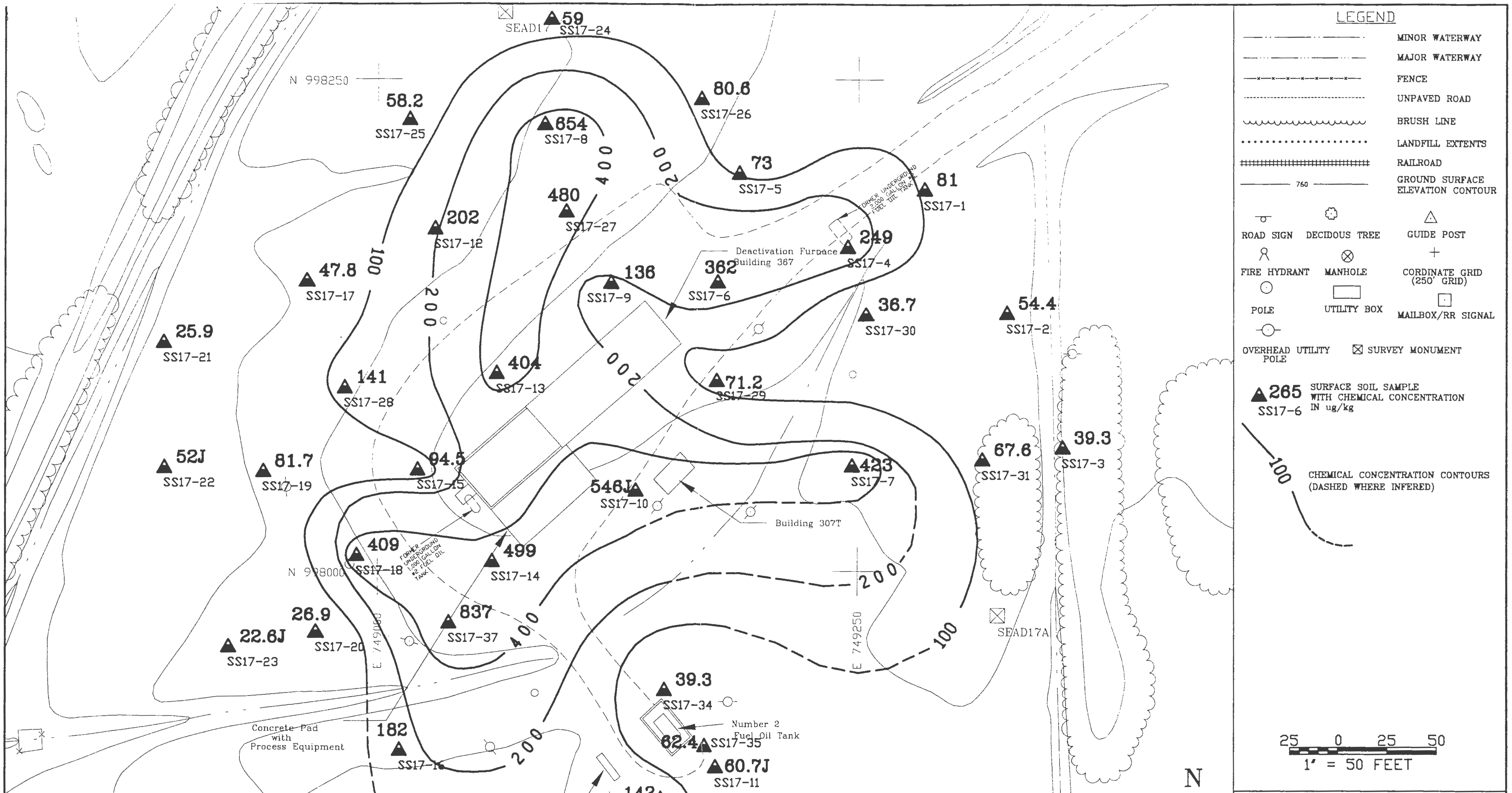
CLIENT/PROJECT TITLE

SENECA ARMY DEPOT
RI/FS
SEAD-17 ACTIVE DEACTIVATION FURNACE

DEPT: ENVIRONMENTAL ENGINEERING
Dwg No.: 729895-01001

FIGURE 4-10
SEAD-17 DISTRIBUTION OF ANTIMONY IN SURFACE SAMPLES

SCALE: 1" = 50'
DATE: JANUARY 1997
REV: A



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PARSONS

PARSONS ENGINEERING SCIENCE, INC.

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT
RI/FS
SEAD-17 ACTIVE DEACTIVATION FURNACE

DEPT. ENVIRONMENTAL ENGINEERING

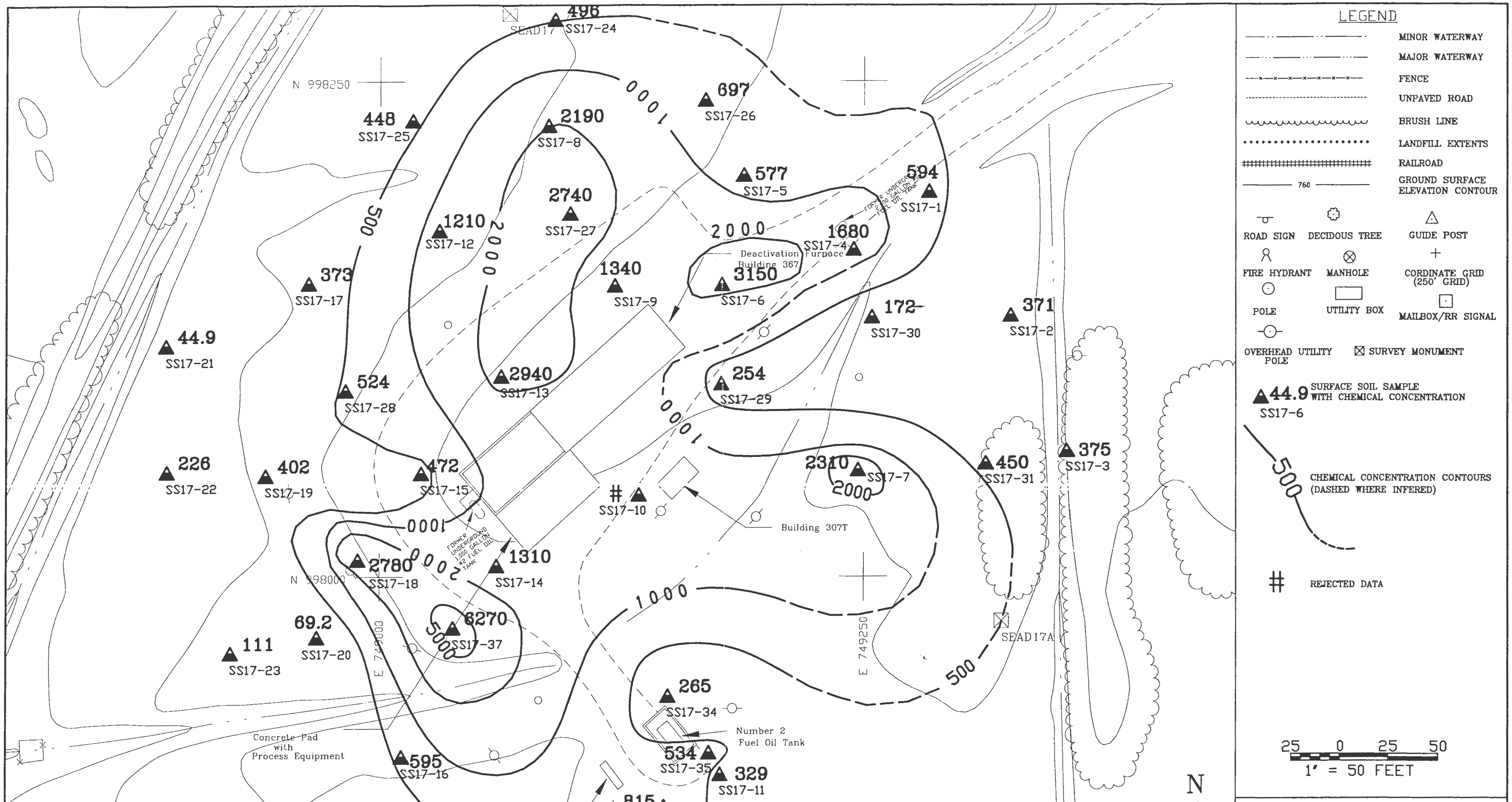
Dwg. No. 729896-01001

FIGURE 4-11
SEAD-17 DISTRIBUTION OF
COPPER IN SURFACE SOILS

SCALE 1" = 50'

DATE MARCH 1999

REV A



PARSONS

PARSONS ENGINEERING SCIENCE, INC.

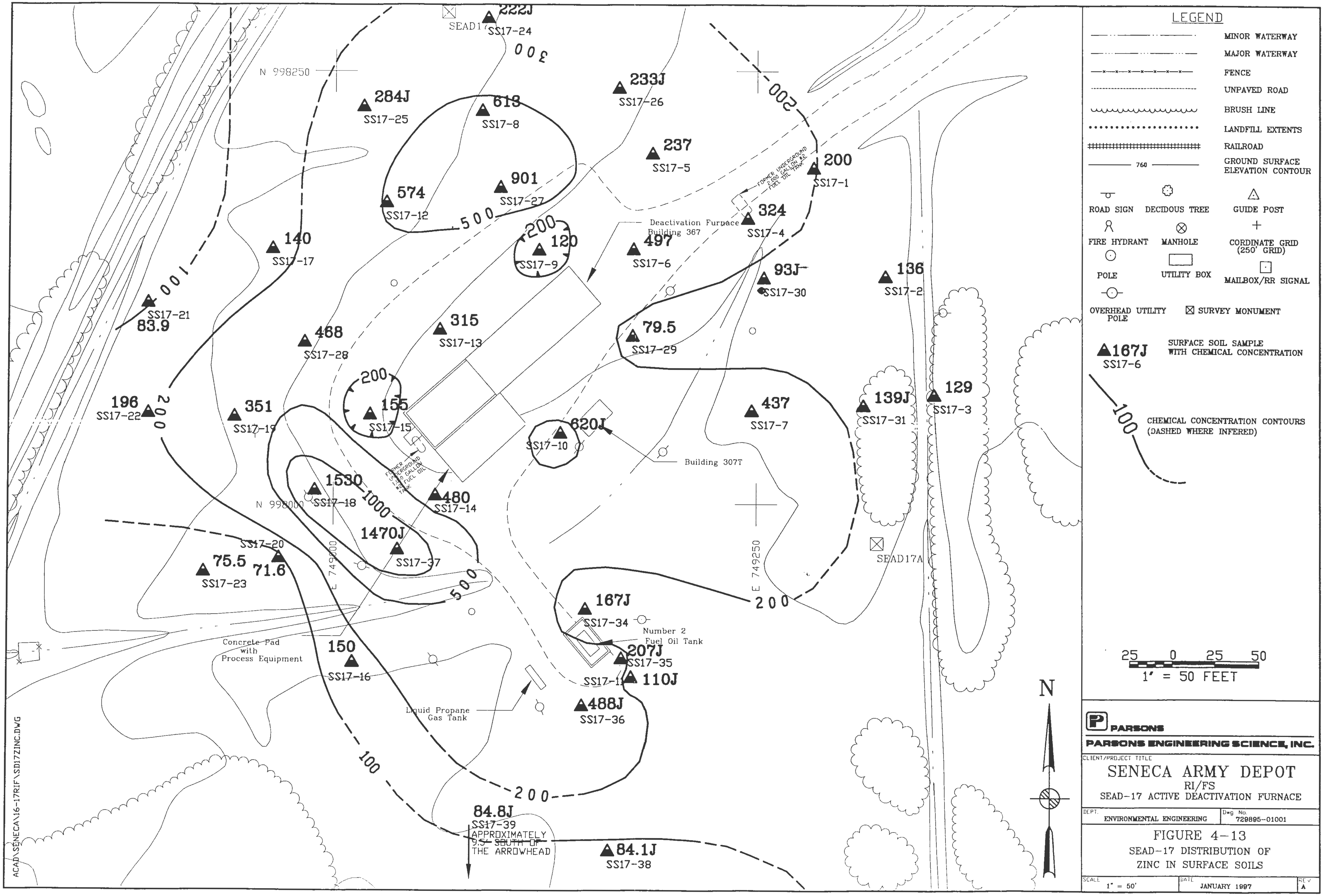
CLIENT/PROJECT TITLE

SENECA ARMY DEPOT
RI/FS
SEAD-17 ACTIVE DEACTIVATION FURNACE

DEPT	Dwg No.
ENVIRONMENTAL ENGINEERING	729895-01001

FIGURE 4-12
SEAD-17 DISTRIBUTION OF
LEAD IN SURFACE SOILS

SCALE	DATE	REV
1" = 50'	JANUARY 1997	A



PARSONS

PARSONS ENGINEERING SCIENCE, INC.

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT
RI/FS
SEAD-17 ACTIVE DEACTIVATION FURNACE

DEPT. ENVIRONMENTAL ENGINEERING

Dwg No. 729895-01001

FIGURE 4-13
SEAD-17 DISTRIBUTION OF ZINC IN SURFACE SOILS

SCALE 1" = 50'

DATE JANUARY 1997

REV A

Chromium was detected in only one sample at a concentration slightly above the TAGM value. Copper was detected in four samples at concentrations slightly above the TAGM value of 25 mg/kg and its maximum concentration of 39 mg/kg was found in sample 1000-N. Lead was detected in seven samples at concentrations above the NYSDEC TAGM value of 21.86 mg/kg. Lead's maximum concentration of 80.8 mg/kg was found in sample 500-S. Mercury was detected in two samples at concentrations above the TAGM value of 0.1 mg/kg. The maximum concentration of mercury (0.56 mg/kg) was detected in sample 3000-N. Nickel was detected in two samples above the TAGM value with the maximum concentration of 50.8 mg/kg found in sample 1000-N. Thallium was detected in two samples above the TAGM value with the maximum concentration of 1.2 mg/kg found in sample 3000-S. Zinc was found in five samples at concentrations slightly above the TAGM value. Zinc's maximum concentration of 109 J mg/kg was found in sample 1000-N.

4.2.2.7 Other Constituents

Nitrate/Nitrite-Nitrogen

Surface Soils

Nitrate/nitrite-nitrogen was detected in all of the surface samples from SEAD-17. The concentrations ranged from 0.06 mg/kg to 1.1 mg/kg (Table 4-31).

Subsurface Soils

Nitrate/nitrite-nitrogen was detected in nine of the ten subsurface samples. The concentrations ranged from 0.05 mg/kg to 0.41 mg/kg (Table 4-33). The two highest concentrations of nitrate/nitrite-nitrogen was found in soil borings SB17-1 and SB17-4. At SB17-1 this compound was detected at a concentration of 0.33 mg/kg from a depth of 2-4 feet and at SB17-4, the concentration of 4.1 mg/kg was detected from a depth of 0-2 feet.

Downwind Surface Soils

Nitrate/nitrite-nitrogen was detected in all of the samples at concentrations ranging from 0.06 mg/kg to 6.1 mg/kg.

4.2.3 Groundwater

A total of five groundwater monitoring wells were installed at SEAD-17. Four monitoring wells, MW17-1, MW17-2, MW17-3, and MW17-4 were installed during the ESI field program and one additional monitoring well, MW17-5, was installed during the RI field program. Three rounds of groundwater sampling were conducted at SEAD-17. One round was conducted for the ESI in late 1993 and early 1994, a second in August 1996 as part of the RI, and a third in December 1996 as part of the RI at SEAD-16. Monitoring well MW17-1 was sampled three times and monitoring wells MW17-2, MW17-3, MW17-4, and MW17-5 was sampled twice. Monitoring wells MW17-2, MW17-3, and MW17-4 were dry at the time of sampling in August 1996.

The discussion below will focus on the more recent groundwater data collected from the wells during the RI (August 1996 and December 1996) because this data depicts the most recent groundwater conditions at SEAD-17, and represents a larger database since one of the wells was not installed during the ESI. Furthermore, the low-flow groundwater sampling method was used during the RI field program resulting in low turbidity groundwater samples, which are more representative of the groundwater at the site.

Groundwater results were compared to the lowest value from the following criteria: New York State (NYS) Class GA standards, Federal Drinking Water Standards Maximum Contaminant Levels (MCLs), and Secondary MCLs.

Summary statistics for the groundwater analyses are shown in Table 4-38. Locations of the monitoring wells are shown in Figure 2-11.

4.2.3.1 Volatile Organic Compounds

Groundwater Sampling Round 1 - August 1996

No VOCs were detected in the groundwater samples collected for Round 1 of the RI (Table 4-39).

VOC TICs were detected in only MW17-5 at SEAD-17 , which is near the No. 2 fuel oil tank (Table 4-40). At this location, total TICs were present at a concentration of 3 µg/L.

Groundwater Sampling Round 2 - December 1996

No VOCs were detected in the five groundwater samples collected for Round 2 of the RI (Table 4-39).

VOC TICs were detected only in MW17-2 at a concentration of 5.79 µg/L.

Table 4-38
SEAD-17 Summary Statistics of Groundwater Samples from Rounds 1 and 2 of Remedial Investigation

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
VOLATILE ORGANICS								
1,1,1,2-Tetrachloroethane	UG/L	8	0	0%				
1,1,1-Trichloroethane	UG/L	8	0	0%				
1,1,2,2-Tetrachloroethane	UG/L	8	0	0%				
1,1,2-Trichloroethane	UG/L	8	0	0%				
1,1-Dichloroethane	UG/L	8	0	0%				
1,1-Dichloroethene	UG/L	8	0	0%				
1,1-Dichloropropene	UG/L	8	0	0%				
1,2,3-Trichlorobenzene	UG/L	8	0	0%				
1,2,3-Trichloropropane	UG/L	8	0	0%				
1,2,4-Trichlorobenzene	UG/L	8	0	0%				
1,2,4-Trimethylbenzene	UG/L	8	0	0%				
1,2-Dibromo-3-chloropropane	UG/L	8	0	0%				
1,2-Dibromoethane	UG/L	8	0	0%				
1,2-Dichlorobenzene	UG/L	8	0	0%				
1,2-Dichloroethane	UG/L	8	0	0%				
1,2-Dichloropropane	UG/L	8	0	0%				
1.3,5-Trimethylbenzene	UG/L	8	0	0%				
1,3-Dichlorobenzene	UG/L	8	0	0%				
1,4-Dichlorobenzene	UG/L	8	0	0%				
1,4-Dioxane	UG/L	8	0	0%				
2,2-Dichloropropane	UG/L	8	0	0%				
2-Butanone	UG/L	8	0	0%				
2-Chlorotoluene	UG/L	8	0	0%				
Acetone	UG/L	8	0	0%				
Benzene	UG/L	8	0	0%				
Bromobenzene	UG/L	8	0	0%				
Bromochloromethane	UG/L	8	0	0%				
Bromodichloromethane	UG/L	8	0	0%				
Bromoform	UG/L	8	0	0%				
Carbon disulfide	UG/L	8	0	0%				
Carbon tetrachloride	UG/L	8	0	0%				
Chlorobenzene	UG/L	8	0	0%				
Chlorodibromomethane	UG/L	8	0	0%				
Chloroethane	UG/L	8	0	0%				
Chloroform	UG/L	8	0	0%				
Cis-1,2-Dichloroethene	UG/L	8	0	0%				
Cis-1,3-Dichloropropene	UG/L	8	0	0%				
Dichlorodifluoromethane	UG/L	8	0	0%				
Ethyl benzene	UG/L	8	0	0%				
Hexachlorobutadiene	UG/L	8	0	0%				
Isopropylbenzene	UG/L	8	0	0%				
Methyl bromide	UG/L	8	0	0%				
Methyl butyl ketone	UG/L	8	0	0%				
Methyl chloride	UG/L	8	0	0%				
Methyl isobutyl ketone	UG/L	8	0	0%				

Table 4-38
SEAD-17 Summary Statistics of Groundwater Samples from Rounds 1 and 2 of Remedial Investigation

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
Methylene bromide	UG/L	8	0	0%				
Methylene chloride	UG/L	8	0	0%				
Naphthalene	UG/L	8	0	0%				
Styrene	UG/L	8	0	0%				
Tetrachloroethene	UG/L	8	0	0%				
Tetrahydrofuran	UG/L	8	0	0%				
Toluene	UG/L	8	0	0%				
Total Xylenes	UG/L	8	0	0%				
Trans-1,2-Dichloroethene	UG/L	8	0	0%				
Trans-1,3-Dichloropropene	UG/L	8	0	0%				
Trichloroethene	UG/L	8	0	0%				
Trichlorofluoromethane	UG/L	8	0	0%				
Vinyl chloride	UG/L	8	0	0%				
n-Butylbenzene	UG/L	8	0	0%				
n-Propylbenzene	UG/L	8	0	0%				
p-Chlorotoluene	UG/L	8	0	0%				
p-Isopropyltoluene	UG/L	8	0	0%				
sec-Butylbenzene	UG/L	8	0	0%				
tert-Butylbenzene	UG/L	8	0	0%				
SEMIVOLATILE ORGANICS								
1,2,4-Trichlorobenzene	UG/L	8	0	0%				
1,2-Dichlorobenzene	UG/L	8	0	0%				
1,3-Dichlorobenzene	UG/L	8	0	0%				
1,4-Dichlorobenzene	UG/L	8	0	0%				
2,4,5-Trichlorophenol	UG/L	8	0	0%				
2,4,6-Trichlorophenol	UG/L	8	0	0%				
2,4-Dichlorophenol	UG/L	8	0	0%				
2,4-Dimethylphenol	UG/L	8	0	0%				
2,4-Dinitrophenol	UG/L	8	0	0%				
2,4-Dinitrotoluene	UG/L	8	0	0%				
2,6-Dinitrotoluene	UG/L	8	0	0%				
2-Chloronaphthalene	UG/L	8	0	0%				
2-Chlorophenol	UG/L	8	0	0%				
2-Methylnaphthalene	UG/L	8	0	0%				
2-Nitroaniline	UG/L	8	0	0%				
2-Nitrophenol	UG/L	8	0	0%				
3,3`-Dichlorobenzidine	UG/L	8	0	0%				
3-Nitroaniline	UG/L	8	0	0%				
4,6-Dinitro-2-methylphenol	UG/L	8	0	0%				
4-Bromophenyl phenyl ether	UG/L	8	0	0%				
4-Chloro-3-methylphenol	UG/L	8	0	0%				
4-Chloroaniline	UG/L	8	0	0%				
4-Chlorophenyl phenyl ether	UG/L	8	0	0%				
4-Nitroaniline	UG/L	8	0	0%				
4-Nitrophenol	UG/L	8	0	0%				
Acenaphthene	UG/L	8	0	0%				

Table 4-38
SEAD-17 Summary Statistics of Groundwater Samples from Rounds 1 and 2 of Remedial Investigation

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
Acenaphthylene	UG/L	8	0	0%				
Anthracene	UG/L	8	0	0%				
Benzo[a]anthracene	UG/L	8	0	0%				
Benzo[a]pyrene	UG/L	8	1	13%	0.7	0.7	0.7	0
Benzo[b]fluoranthene	UG/L	8	0	0%				
Benzo[ghi]perylene	UG/L	8	2	25%	1	2	1.5	0.707
Benzo[k]fluoranthene	UG/L	8	0	0%				
Bis(2-Chloroethoxy)methane	UG/L	8	0	0%				
Bis(2-Chloroethyl)ether	UG/L	8	0	0%				
Bis(2-Chloroisopropyl)ether	UG/L	8	0	0%				
Bis(2-Ethylhexyl)phthalate	UG/L	8	0	0%				
Butylbenzylphthalate	UG/L	8	0	0%				
Carbazole	UG/L	8	0	0%				
Chrysene	UG/L	8	0	0%				
Cresols (-o)	UG/L	8	0	0%				
Cresols (-p)	UG/L	8	0	0%				
Di-n-butylphthalate	UG/L	8	0	0%				
Di-n-octylphthalate	UG/L	8	0	0%				
Dibenz[a,h]anthracene	UG/L	8	2	25%	0.9	1	0.95	0.071
Dibenzofuran	UG/L	8	0	0%				
Diethyl phthalate	UG/L	8	0	0%				
Dimethylphthalate	UG/L	8	0	0%				
Fluoranthene	UG/L	8	0	0%				
Fluorene	UG/L	8	0	0%				
Hexachlorobenzene	UG/L	8	0	0%				
Hexachlorobutadiene	UG/L	8	0	0%				
Hexachlorocyclopentadiene	UG/L	8	0	0%				
Hexachloroethane	UG/L	8	0	0%				
Indeno[1,2,3-cd]pyrene	UG/L	8	2	25%	1	2	1.5	0.707
Isophorone	UG/L	8	0	0%				
N-Nitrosodiphenylamine	UG/L	8	0	0%				
N-Nitrosodipropylamine	UG/L	8	0	0%				
Naphthalene	UG/L	8	0	0%				
Nitrobenzene	UG/L	8	0	0%				
Pentachlorophenol	UG/L	8	0	0%				
Phenanthrene	UG/L	8	0	0%				
Phenol	UG/L	8	0	0%				
Pyrene	UG/L	8	0	0%				
PESTICIDES/PCB								
4,4`-DDD	UG/L	8	0	0%				
4,4`-DDE	UG/L	8	0	0%				
4,4`-DDT	UG/L	8	0	0%				
Aldrin	UG/L	8	0	0%				
Alpha-BHC	UG/L	8	0	0%				
Alpha-Chlordane	UG/L	8	0	0%				
Aroclor-1016	UG/L	8	0	0%				

Table 4-38
SEAD-17 Summary Statistics of Groundwater Samples from Rounds 1 and 2 of Remedial Investigation

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Parameter	**Units**	**Total Count**	**Hit Count**	**Frequency**	**Min. Conc.**	**Max. Conc.**	**Average**	**Standard Deviation**
Aroclor-1221	UG/L	8	0	0%				
Aroclor-1232	UG/L	8	0	0%				
Aroclor-1242	UG/L	8	0	0%				
Aroclor-1248	UG/L	8	0	0%				
Aroclor-1254	UG/L	8	0	0%				
Aroclor-1260	UG/L	8	0	0%				
Beta-BHC	UG/L	8	0	0%				
Delta-BHC	UG/L	8	0	0%				
Dieldrin	UG/L	8	0	0%				
Endosulfan I	UG/L	8	0	0%				
Endosulfan II	UG/L	8	0	0%				
Endosulfan sulfate	UG/L	8	0	0%				
Endrin	UG/L	8	0	0%				
Endrin aldehyde	UG/L	8	0	0%				
Endrin ketone	UG/L	8	0	0%				
Gamma-BHC/Lindane	UG/L	8	0	0%				
Gamma-Chlordane	UG/L	8	0	0%				
Heptachlor	UG/L	8	0	0%				
Heptachlorepoxide	UG/L	8	0	0%				
Methoxychlor	UG/L	8	0	0%				
Toxaphene	UG/L	8	0	0%				
OTHER ANALYSES								
Nitrate/Nitrite Nitrogen	MG/L	8	8	100%	0.02	0.24	0.105	0.099
Percent Moisture (PEST/PCB)		8	8	100%				
Percent Moisture (SVOCs)		8	8	100%				
Percent Moisture (VOCs)		8	8	100%				
Percent Solids (Metals)		8	8	100%	0	0	0	0
Total Petroleum Hydrocarbons	MG/L	3	0	0%				
NITROAROMATICS								
1,3,5-Trinitrobenzene	UG/L	8	0	0%				
1,3-Dinitrobenzene	UG/L	8	0	0%				
2,4,6-Trinitrotoluene	UG/L	8	0	0%				
2,4-Dinitrotoluene	UG/L	8	0	0%				
2,6-Dinitrotoluene	UG/L	8	0	0%				
2-amino-4,6-Dinitrotoluene	UG/L	3	0	0%				
4-amino-2,6-Dinitrotoluene	UG/L	8	0	0%				
HMX	UG/L	8	0	0%				
Nitrobenzene	UG/L	8	0	0%				
RDX	UG/L	8	0	0%				
Tetryl	UG/L	8	1	13%	0.08	0.08	0.08	0
METALS								
Aluminum	UG/L	8	4	50%	39.9	386	142.725	163.564
Antimony	UG/L	8	0	0%				
Arsenic	UG/L	8	0	0%				
Barium	UG/L	8	3	38%	85	92.5	88.167	3.884
Beryllium	UG/L	8	3	38%	0.21	0.26	0.233	0.025

Table 4-38
SEAD-17 Summary Statistics of Groundwater Samples from Rounds 1 and 2 of Remedial Investigation

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Parameter	**Units**	**Total Count**	**Hit Count**	**Frequency**	**Min. Conc.**	**Max. Conc.**	**Average**	**Standard Deviation**
Cadmium	UG/L	8	1	13%	0.31	0.31	0.31	0
Calcium	UG/L	8	8	100%	81100	118000	103637.5	11633.44
Chromium	UG/L	8	1	13%	1.5	1.5	1.5	0
Cobalt	UG/L	8	1	13%	1.4	1.4	1.4	0
Copper	UG/L	8	3	38%	3.1	4.3	3.567	0.643
Cyanide	UG/L	8	0	0%				
Iron	UG/L	8	6	75%	56.8	572	197.733	190.757
Lead	UG/L	8	0	0%				
Magnesium	UG/L	8	8	100%	13600	23000	17975	4199.575
Manganese	UG/L	8	6	75%	20	73.8	45.467	26.853
Mercury	UG/L	8	0	0%				
Nickel	UG/L	8	3	38%	1.8	2.4	2.133	0.306
Potassium	UG/L	8	4	50%	472	5320	1804.75	2349.027
Selenium	UG/L	8	0	0%				
Silver	UG/L	8	1	13%	2.3	2.3	2.3	0
Sodium	UG/L	8	8	100%	8190	30100	14858.75	8017.89
Thallium	UG/L	8	3	38%	4.4	7.1	5.4	1.48
Vanadium	UG/L	8	1	13%	1.4	1.4	1.4	0
Zinc	UG/L	8	1	13%	63.9	63.9	63.9	0

Table 4-39
SEAD-17 Summary of Analytes Detected in Groundwater

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC ID:	MW17-1		MW17-1		MW17-1		MW17-1		MW17-2		MW17-2	
			SAMP ID:	MW17-1-1		16108		16109		16171		MW17-2-1		16163	
			QC CODE:	SA		SA		DU		SA		SA		SA	
			STUDY ID:	ESI		RI ROUND1		RI ROUND1		RI ROUND2		ESI		RI ROUND2	
			TOP:	3.4		3.4		3.4		731.1		3.3		728.3	
			BOTTOM:	7.4		7.4		7.4		727.1		5.3		726.3	
			MATRIX:	Groundwater		Groundwater		Groundwater		Groundwater		Groundwater		Groundwater	
			SAMPLE DATE:	1/25/94		8/29/96		8/29/96		12/11/96		11/18/93		12/9/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
SEMIVOLATILE ORGANICS															
Benzo[a]pyrene	ND	NYS CLASS GA STANDARD	UG/L	11	U	**0.7**	**J**	10	U	10	U	11	U	10	U
Benzo[ghi]perylene			UG/L	11	U	2	J	1	J	10	U	11	U	10	U
Dibenz[a,h]anthracene			UG/L	11	U	1	J	0.9	J	10	U	11	U	10	U
Indeno[1,2,3-cd]pyrene			UG/L	11	U	2	J	1	J	10	U	11	U	10	U
OTHER ANALYSES															
Nitrate/Nitrite Nitrogen			MG/L	0.26		0.24		0.23		0.2		0.13		0.04	
Percent Solids (Metals)						0		0		0				0	
NITROAROMATICS															
Tetryl	5	NYS CLASS GA STANDARD	UG/L	0.13	U	0.26	U	0.26	U	0.26	U	0.08	J	0.26	U
METALS															
Aluminum	200	EPA SECONDARY MCL	UG/L	**10800**		90.4		54.6		**386**		**7220**		85.3	U
Arsenic	25		UG/L	5.8	J	2.7	U	2.7	U	4.4	U	3.2	J	4.4	U
Barium	1000	NYS CLASS GA STANDARD	UG/L	147	J	85		87		90.4	U	77.9	J	66.1	U
Beryllium	4	EPA MCL	UG/L	0.52	J	0.26		0.21		0.2	U	0.4	J	0.2	U
Cadmium	5	EPA MCL	UG/L	2.1	U	0.3	U	0.31		0.6	U	3.3	U	0.6	U
Calcium			UG/L	170000		108000		110000		104000		149000		118000	
Chromium	50	NYS CLASS GA STANDARD	UG/L	17.3		1	U	1.5		1	U	12.9		1	U
Cobalt			UG/L	11.4	J	1.2	U	1.4		2	U	7	J	1.3	U
Copper	200	NYS CLASS GA STANDARD	UG/L	18	J	3.1		4.3		1.1	U	11.7	J	2.6	U
Iron	300	NYS CLASS GA STANDARD	UG/L	**18300**		119		90.6		**572**	**J**	**12200**		214	
Lead	15	EPA MCL	UG/L	8.7		1.7	U	1.7	U	1.5	U	**32.3**		1.9	U
Magnesium			UG/L	40200		22600		23000		22900		24400		14600	
Manganese	50	EPA SECONDARY MCL	UG/L	**473**		21.3		20		9.7	U	**459**		**73.8**	
Mercury	2	NYS CLASS GA STANDARD	UG/L	0.05	J	0.1	U	0.1	U	0.1	U	0.07	UJ	0.1	U
Nickel	100	EPA MCL	UG/L	24.4	J	1.8		2.2		2.5	U	15.4	J	2.5	U
Potassium			UG/L	4740	J	472		574		843	U	4280	J	5320	
Selenium	10	NYS CLASS GA STANDARD	UG/L	2	J	2.4	U	2.4	U	4.7	UJ	0.79	U	4.7	UJ
Silver	50	NYS CLASS GA STANDARD	UG/L	4.2	U	1.3	U	2.3		1.5	U	6.6	U	1.5	U
Sodium	20000	NYS CLASS GA STANDARD	UG/L	8270		9290		9620		8190		**44300**		18700	
Thallium	2	EPA MCL	UG/L	1.2	U	**4.4**		**7.1**		4.1	U	1.8	U	4.7	U
Vanadium			UG/L	19.9	J	1.2	U	1.4		1.6	U	12.8	J	1.6	U
Zinc	300	NYS CLASS GA STANDARD	UG/L	100		2.5	R	3.2	R	14.4	U	33		63.9	

Note: Shaded values exceed the NYS Class GA Standard or EPA MCL.

Table 4-39
SEAD-17 Summary of Analytes Detected in Groundwater

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC ID:	MW17-3		MW17-3		MW17-4		MW17-4		MW17-5		MW17-5	
			SAMP ID:	MW17-3-1		16166		MW17-4-1		16169		16106		16170	
			QC CODE:	SA		SA		SA		SA		SA		SA	
			STUDY ID:	ESI		RI ROUND2		ESI		RI ROUND2		RI ROUND1		RI ROUND2	
			TOP:	3.1		727.1		3.1		729.4		3.4		728.1	
			BOTTOM:	5.1		725.1		5.1		727.4		7.9		723.6	
			MATRIX:	roundwater		Groundwater		Groundwater		Groundwater		Groundwater		Groundwater	
			SAMPLE DATE:	1/26/94		12/10/96		1/25/94		12/11/96		8/29/96		12/11/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
SEMIVOLATILE ORGANICS															
Benzo[a]pyrene	ND	NYS CLASS GA STANDARD	UG/L	10	U	10	U	11	U	10	U	10	U	10	U
Benzo[ghi]perylene			UG/L	10	U	10	U	11	U	10	U	10	U	10	U
Dibenz[a,h]anthracene			UG/L	10	U	10	U	11	U	10	U	10	U	10	U
Indeno[1,2,3-cd]pyrene			UG/L	10	U	10	U	11	U	10	U	10	U	10	U
OTHER ANALYSES															
Nitrate/Nitrite Nitrogen			MG/L	0.09		0.05		0.05		0.02		0.04		0.02	
Percent Solids (Metals)						0				0		0		0	
NITROAROMATICS															
Tetryl	5	NYS CLASS GA STANDARD	UG/L	0.13	U	0.26	U	0.13	U	0.26	U	0.26	U	0.26	U
METALS															
Aluminum	200	EPA SECONDARY MCL	UG/L	**1070**		36.1	U	**774**		41.9	U	39.9		59	U
Arsenic	25		UG/L	1.4	U	4.4	U	0.87	J	4.4	U	2.7	U	4.4	U
Barium	1000	NYS CLASS GA STANDARD	UG/L	24.4	J	27.4	U	33.4	J	27.4	U	92.5		62.6	U
Beryllium	4	EPA MCL	UG/L	0.4	U	0.2	U	0.4	U	0.2	U	0.23		0.2	U
Cadmium	5	EPA MCL	UG/L	2.1	U	0.6	U	2.1	U	0.6	U	0.3	U	0.6	U
Calcium			UG/L	110000		108000		113000		92000		108000		81100	
Chromium	50	NYS CLASS GA STANDARD	UG/L	2.6	U	1	U	2.6	U	1	U	1	U	1	U
Cobalt			UG/L	4.4	U	1.3	U	4.4	U	1.3	U	1.2	U	1.3	U
Copper	200	NYS CLASS GA STANDARD	UG/L	3.1	U	1.1	U	3.1	U	1.1	U	3.3		1.3	U
Iron	300	NYS CLASS GA STANDARD	UG/L	**1870**		53.1	U	**1100**		96.4	U	56.8		134	
Lead	15	EPA MCL	UG/L	0.52	J	1.5	U	1.9	J	3	U	1.7	U	1.5	U
Magnesium			UG/L	17800		15200		17800		14200		17700		13600	
Manganese	50	EPA SECONDARY MCL	UG/L	**164**		0.7	U	**550**		22.5		**73.2**		**62**	
Mercury	2	NYS CLASS GA STANDARD	UG/L	0.04	U	0.1	U	0.07	J	0.1	U	0.1	U	0.1	U
Nickel	100	EPA MCL	UG/L	4	U	2.5	U	4	U	2.5	U	2.4		2.5	U
Potassium			UG/L	3590	J	772	U	5820		1330	U	853		1070	U
Selenium	10	NYS CLASS GA STANDARD	UG/L	0.69	U	4.7	UJ	0.7	U	4.7	UJ	2.4	U	4.7	UJ
Silver	50	NYS CLASS GA STANDARD	UG/L	4.2	U	1.5	U	4.2	U	1.5	U	1.3	U	1.5	U
Sodium	20000	NYS CLASS GA STANDARD	UG/L	**46100**		**30100**		17200		**22300**		11700		8970	
Thallium	2	EPA MCL	UG/L	1.2	U	4.4	U	1.2	U	6.2	U	**4.7**		8.6	U
Vanadium			UG/L	3.7	U	1.6	U	3.7	U	1.6	U	1.2	U	1.6	U
Zinc	300	NYS CLASS GA STANDARD	UG/L	16.4	J	7.7	U	13	J	8.3	U	6.2	R	4.4	U

Note: Shaded values exceed the NYS Class GA Standard or EPA MCL.

Table 4-39
SEAD-17 Summary of Analytes Detected in Groundwater

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

LOC_ID:				MW17-4		MW17-5	
SAMP ID:				MW17-4-1		16106	
QC CODE:				SA		SA	
STUDY ID:				ESI		RI ROUND1	
TOP:				3.1		3.4	
BOTTOM:				5.1		7.9	
MATRIX:				WATER		WATER	
SAMPLE DATE:				1/25/94		8/29/96	
				VALUE	Q	VALUE	Q
SEMIVOLATILE ORGANICS							
Benzo(a)pyrene	2	EPA MCL	UG/L	11	U	10	U
Benzo(g,h,i)perylene			UG/L	11	U	10	U
Dibenz(a,h)anthracene			UG/L	11	U	10	U
Indeno(1,2,3-cd)pyrene			UG/L	11	U	10	U
OTHER ANALYSES							
Nitrate/Nitrite-Nitrogen			MG/L	0.05		0.04	
Percent Solids (Metals)						0	
NITROAROMATICS							
Tetryl	5	NYS CLASS GA STANDARD	UG/L	0.13	U	0.26	U
METALS							
Aluminum	200	EPA SECONDARY MCL	UG/L	774		39.9	
Arsenic	25	NYS CLASS GA STANDARD	UG/L	0.87	J	2.7	U
Barium	1000	NYS CLASS GA STANDARD	UG/L	33.4	J	92.5	
Beryllium	4	EPA MCL	UG/L	0.4	U	0.23	
Cadmium	5	EPA MCL	UG/L	2.1	U	0.3	U
Calcium			UG/L	113000		108000	
Chromium	50	NYS CLASS GA STANDARD	UG/L	2.6	U	1	U
Cobalt			UG/L	4.4	U	1.2	U
Copper	200	NYS CLASS GA STANDARD	UG/L	3.1	U	3.3	

Note: Shaded values exceed the NYS Class GA Standard or EPA MCL.

Table 4-39
SEAD-17 Summary of Analytes Detected in Groundwater

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

LOC_ID:				MW17-4		MW17-5	
SAMP ID:				MW17-4-1		16106	
QC CODE:				SA		SA	
STUDY ID:				ESI		RI ROUND1	
TOP:				3.1		3.4	
BOTTOM:				5.1		7.9	
MATRIX:				WATER		WATER	
SAMPLE DATE:				1/25/94		8/29/96	
				VALUE	Q	VALUE	Q
Iron	300	NYS CLASS GA STANDARD	UG/L	1100		56.8	
Lead	15	EPA MCL	UG/L	1.9	J	1.7	U
Magnesium			UG/L	17800		17700	
Manganese	50	EPA SECONDARY MCL	UG/L	550		73.2	
Mercury	2	NYS CLASS GA STANDARD	UG/L	0.07	J	0.1	U
Nickel	100	EPA MCL	UG/L	4	U	2.4	
Potassium			UG/L	5820		853	
Selenium	10	NYS CLASS GA STANDARD	UG/L	0.7	U	2.4	U
Silver	50	NYS CLASS GA STANDARD	UG/L	4.2	U	1.3	U
Sodium	20000	NYS CLASS GA STANDARD	UG/L	17200		11700	
Thallium	2	EPA MCL	UG/L	1.2	U	4.7	
Vanadium			UG/L	3.7	U	1.2	U
Zinc	300	NYS CLASS GA STANDARD	UG/L	13	J	6.2	R

Note: Shaded values exceed the NYS Class GA Standard or EPA MCL.

Table 4-39
SEAD-17 Summary of Analytes Detected in Groundwater

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

LOC_ID:				MW17-4		MW17-5	
SAMP ID:				MW17-4-1		16106	
QC CODE:				SA		SA	
STUDY ID:				ESI		RI ROUND1	
TOP:				3.1		3.4	
BOTTOM:				5.1		7.9	
MATRIX:				WATER		WATER	
SAMPLE DATE:				1/25/94		8/29/96	
				VALUE	Q	VALUE	Q
Iron	300	NYS CLASS GA STANDARD	UG/L	1100		56.8	
Lead	15	EPA MCL	UG/L	1.9	J	1.7	U
Magnesium			UG/L	17800		17700	
Manganese	50	EPA SECONDARY MCL	UG/L	550		73.2	
Mercury	2	NYS CLASS GA STANDARD	UG/L	0.07	J	0.1	U
Nickel	100	EPA MCL	UG/L	4	U	2.4	
Potassium			UG/L	5820		853	
Selenium	10	NYS CLASS GA STANDARD	UG/L	0.7	U	2.4	U
Silver	50	NYS CLASS GA STANDARD	UG/L	4.2	U	1.3	U
Sodium	20000	NYS CLASS GA STANDARD	UG/L	17200		11700	
Thallium	2	EPA MCL	UG/L	1.2	U	4.7	
Vanadium			UG/L	3.7	U	1.2	U
Zinc	300	NYS CLASS GA STANDARD	UG/L	13	J	6.2	R

Note: Shaded values exceed the NYS Class GA Standard or EPA MCL.

Table 4-40

VOCs and TICs in Groundwater (ug/L)

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Monitoring Well ID	Sample ID	Study ID	Total TCL TICs	Total TICs	Total All VOCs
MW17-1	MW17-1-1	ESI	0	0	0
MW17-1	16108	Round I	0	0	0
MW17-1	16109	Round I	0	0	0
MW17-2	MW17-2-1	ESI	0	0	0
MW17-2	Not Sampled (1)	Not Sampled	Not Sampled	Not Sampled	Not Sampled
MW17-3	MW17-3-1	ESI	0	0	0
MW17-3	Not Sampled (1)	Not Sampled	Not Sampled	Not Sampled	Not Sampled
MW17-4	MW17-4-1	ESI	0	0	0
MW17-4	Not Sampled (1)	Not Sampled	Not Sampled	Not Sampled	Not Sampled
MW17-5	16106	Round I	0	3	3

(1) Not Sampled. There was an insufficient amount of standing water to sample.

4.2.3.2 Semivolatile Organic Compounds

Groundwater Sampling Round 1 - August 1996

Four SVOCs were detected in the groundwater at SEAD-17. All four of the SVOCs were detected in groundwater from MW17-1. Benzo(a)pyrene was detected above the NYS Class GA standard of ND (Table 4-39). The SVOCs benzo(g,h,i)perylene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene) were detected in MW17-1 at concentrations below the applicable NYS Class GA standard. This well is located east of the Deactivation Furnace.

The EPA MCL value for the compound benzo(a)pyrene (2 μg/L) was exceeded by the detection limits for most of the samples.

Of the wells sampled during Round 1, the highest concentration of TICs (5.7 μg/L) was found in well MW17-1 (Table 4-41).

Groundwater Sampling Round 2 - December 1996

No SVOCs were detected in the five groundwater samples collected for Round 2.

The highest concentration of TICs (29 μg/L) was found in well MW17-2.

4.2.3.3 Pesticide and PCBs

Groundwater Sampling Round 1 - August 1996

No pesticides or PCBs were found in the groundwater samples collected from the two monitoring wells sampled at the site.

Groundwater Sampling Round 2 - December 1996

No pesticides or PCBs were found in the groundwater samples collected from the Round 2 groundwater samples.

4.2.3.4 Nitroaromatics

Groundwater Sampling Round 1 - August 1996

No nitroaromatics were detected in the groundwater samples collected from the two monitoring wells MW17-1 and MW17-5 during the RI.

Detection limits for the compound tetryl were below the NYS Class GA Standard.

Groundwater Sampling Round 2 - December 1996

No nitroaromatics were detected in the five groundwater samples collected during Round 2.

4.2.3.5 Herbicides

Herbicides were not analyzed in the groundwater samples collected during the RI sampling program. [As a note, no herbicides were found in the four monitoring wells sampled during the ESI program.]

4.2.3.6 Metals

Groundwater Sampling Round 1 - August 1996

Metals were detected in the groundwater samples collected from the two monitoring wells MW17-1 and MW17-5 sampled during the RI program (Table 4-39). Two metals, manganese and thallium, were found at concentrations that exceeded their respective NYS Class GA or Federal MCL standard. The EPA Secondary MCL for manganese was exceeded in one well, MW17-5 (73.2 μg/L). The EPA MCL for thallium was exceeded in samples from both monitoring wells. A maximum concentration of 4.7 μg/L was detected in the groundwater sample from MW17-5.

No detection limits exceeded the respective EPA MCLs or NYS Class GA Standards for the metals.

Groundwater Sampling Round 2 - December 1996

Metals were detected in the groundwater samples collected from the five monitoring wells sampled during the Round 2 of the RI program (Table 4-39). Four metals, aluminum, iron, manganese, and sodium, were found at concentrations that exceeded their respective NYS Class GA or Federal MCL standard. The EPA Secondary MCL for aluminum was exceeded in one well, MW17-1, (386 μg/L). Iron, with a concentration of 572 μg/L, exceeded the GA standard in only one well. The EPA Secondary MCL for manganese was exceeded in two wells, MW17-2 (73.8 μg/L) and MW17-5 (62 μg/L). The EPA MCL for sodium was exceeded in samples from the two monitoring wells, MW17-3 (30,100 μg/L) and MW17-4 (22,300 μg/L).

No detection limits exceeded the respective EPA MCLs or NYS Class GA standards for the metals.

Table 4-41

SVOCs and TICs in Groundwater (ug/L)

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Monitoring Well ID	Sample ID	Study ID	Total SVOC TICs	Total TICs	Total All SVOCs
MW17-1	MW17-1-1	ESI	0.0	360	360.0
MW17-1	16108	Round I	5.7	0	5.7
MW17-1	16109	Round I	2.9	0	2.9
MW17-2	MW17-2-1	ESI	0.0	43	43.0
MW17-2	Not Sampled (1)	Not Sampled	Not Sampled	Not Sampled	Not Sampled
MW17-3	MW17-3-1	ESI	0.0	0	0.0
MW17-3	Not Sampled (1)	Not Sampled	Not Sampled	Not Sampled	Not Sampled
MW17-4	MW17-4-1	ESI	0.0	0	0.0
MW17-4	Not Sampled (1)	Not Sampled	Not Sampled	Not Sampled	Not Sampled
MW17-5	16106	Round I	0.0	0	0.0

(1) Not Sampled. There was an insufficient amount of standing water to sample.

4.2.3.7 Other constituents

Nitrate/Nitrite-Nitrogen

Groundwater Sampling Program Round 1 - August 1996

Nitrate/nitrite-nitrogen was detected in groundwater from both wells in concentrations of 0.04 mg/L and 0.24 mg/L.

Groundwater Sampling Program Round 2 - December 1996

Nitrate/nitrite-nitrogen was detected in groundwater from all wells in concentrations ranging from 0.02 mg/L and 0.2 mg/L.

4.2.4 Surface Water

The surface water at SEAD-17 has not been classified by NYSDEC. However, because the drainage ditches near SEAD-17 form the headwaters for Kendaia Creek, the lower portion of which is designated as Class C surface water by NYSDEC, the Class C standards were used to provide a basis of comparison for the on-site surface water chemical data. The Class C standards are not strictly applicable to the surface water found at SEAD-17 .

Summary statistics for the surface water analyses are shown in Table 4-42.

4.2.4.1 Volatile Organic Compounds

No volatile organic compounds were detected in the groundwater samples collected at SEAD-17 (Table 4-43).

VOC TICs were identified in one sample, SW/SD17-6 at a concentration of 5 μg/L (Table 4-44).

4.2.4.2 Semivolatile Organic Compounds

One SVOC was detected in the surface water at SEAD-17. Bis(2-ethylhexyl)phthalate was detected in two samples at concentrations above applicable New York State Class C surface water standard of 0.6 μg/L. A maximum concentration of 2 J μg/L was detected in SW/SD17-3.

The TAGM value for the compound bis(2-ethylhexyl)phthalate was exceeded by the detection limit of 10 μg/L.

SVOC TICs were found in almost all of the surface water samples at SEAD-17 (Table 4-45). The highest concentration was found at SW/SD17-3 (29 μg/L).

4.2.4.3 Pesticide and PCBs

No pesticides were detected in the surface water samples at the site.

4.2.4.4 Nitroaromatics

No nitroaromatic compounds were detected in the surface water samples collected from SEAD-17.

4.2.4.5 Herbicides

Herbicides were not part of the laboratory analytical suite for surface water samples collected from SEAD-17.

4.2.4.6 Metals

NYS Class C surface water quality standards were used as a basis of comparison for the surface water samples. The Class C surface water quality standard values for chromium, copper, lead, nickel, and zinc are based on the hardness of the surface water at the site. Hardness was calculated using the same method described in Freeze and Cherry (1979). The average calcium and magnesium concentrations used to calculate hardness were 64.4 mg/L and 6.6 mg/L, respectively; the values were obtained from the background surface water sample locations SW/SD16-10, SW/SD17-1, and SW/SD17-4. A hardness value of 188.18 mg/L was calculated for SEAD-17 . This hardness value was used in the calculation of the NYS Class C standards for the metals mentioned above.

Metals were detected at all 10 surface water sampling locations at the site (Table 4-43). Four metals (copper, iron, lead, and selenium) were found at concentrations that exceeded their respective NYS Class C surface water standards. Copper exceeded the Class C standard in only one location (SW/SD17-7) where a concentration of 32.7 μg/L was detected. Iron, which exceeded the standard at only one location (SW/SD17-1), was found at a concentration of 322 J μg/L. Lead exceeded the Class standard of 7.16 μg/L at three locations. Lead's maximum concentration of 37.1 μg/L was detected in SW/SD17-7. Selenium was detected in five samples

Table 4-42
SEAD-17 Summary Statistics for Surface Water Samples

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
VOLATILE ORGANICS								
1,1,1-Trichloroethane	UG/L	10	0	0%				
1,1,2,2-Tetrachloroethane	UG/L	10	0	0%				
1,1,2-Trichloroethane	UG/L	10	0	0%				
1,1-Dichloroethane	UG/L	10	0	0%				
1,1-Dichloroethene	UG/L	10	0	0%				
1,2-Dichloroethane	UG/L	10	0	0%				
1,2-Dichloroethene (total)	UG/L	10	0	0%				
1,2-Dichloropropane	UG/L	10	0	0%				
2-Butanone	UG/L	10	0	0%				
2-Hexanone	UG/L	10	0	0%				
4-Methyl-2-Pentanone	UG/L	10	0	0%				
Acetone	UG/L	10	0	0%				
Benzene	UG/L	10	0	0%				
Bromodichloromethane	UG/L	10	0	0%				
Bromoform	UG/L	10	0	0%				
Bromomethane	UG/L	10	0	0%				
Carbon Disulfide	UG/L	10	0	0%				
Carbon Tetrachloride	UG/L	10	0	0%				
Chlorobenzene	UG/L	10	0	0%				
Chloroethane	UG/L	10	0	0%				
Chloroform	UG/L	10	0	0%				
Chloromethane	UG/L	10	0	0%				
Dibromochloromethane	UG/L	10	0	0%				
Ethylbenzene	UG/L	10	0	0%				
Methylene Chloride	UG/L	10	0	0%				
Styrene	UG/L	10	0	0%				
Tetrachloroethene	UG/L	10	0	0%				
Toluene	UG/L	10	0	0%				
Trichloroethene	UG/L	10	0	0%				
Vinyl Chloride	UG/L	10	0	0%				
Xylene (total)	UG/L	10	0	0%				
cis-1,3-Dichloropropene	UG/L	10	0	0%				
trans-1,3-Dichloropropene	UG/L	10	0	0%				
SEMIVOLATILE ORGANICS								
1,2,4-Trichlorobenzene	UG/L	10	0	0%				
1,2-Dichlorobenzene	UG/L	10	0	0%				
1,3-Dichlorobenzene	UG/L	10	0	0%				
1,4-Dichlorobenzene	UG/L	10	0	0%				
2,4,5-Trichlorophenol	UG/L	10	0	0%				

Table 4-42
SEAD-17 Summary Statistics for Surface Water Samples

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
2,4,6-Trichlorophenol	UG/L	10	0	0%				
2,4-Dichlorophenol	UG/L	10	0	0%				
2,4-Dimethylphenol	UG/L	10	0	0%				
2,4-Dinitrophenol	UG/L	10	0	0%				
2,4-Dinitrotoluene	UG/L	10	0	0%				
2,6-Dinitrotoluene	UG/L	10	0	0%				
2-Chloronaphthalene	UG/L	10	0	0%				
2-Chlorophenol	UG/L	10	0	0%				
2-Methylnaphthalene	UG/L	10	0	0%				
2-Methylphenol	UG/L	10	0	0%				
2-Nitroaniline	UG/L	10	0	0%				
2-Nitrophenol	UG/L	10	0	0%				
3,3'-Dichlorobenzidine	UG/L	10	0	0%				
3-Nitroaniline	UG/L	10	0	0%				
4,6-Dinitro-2-methylphenol	UG/L	10	0	0%				
4-Bromophenyl-phenylether	UG/L	10	0	0%				
4-Chloro-3-methylphenol	UG/L	10	0	0%				
4-Chloroaniline	UG/L	10	0	0%				
4-Chlorophenyl-phenylether	UG/L	10	0	0%				
4-Methylphenol	UG/L	10	0	0%				
4-Nitroaniline	UG/L	10	0	0%				
4-Nitrophenol	UG/L	10	0	0%				
Acenaphthene	UG/L	10	0	0%				
Acenaphthylene	UG/L	10	0	0%				
Anthracene	UG/L	10	0	0%				
Benzo(a)anthracene	UG/L	10	0	0%				
Benzo(a)pyrene	UG/L	10	0	0%				
Benzo(b)fluoranthene	UG/L	10	0	0%				
Benzo(g,h,i)perylene	UG/L	10	0	0%				
Benzo(k)fluoranthene	UG/L	10	0	0%				
Butylbenzylphthalate	UG/L	10	0	0%				
Carbazole	UG/L	10	0	0%				
Chrysene	UG/L	10	0	0%				
Di-n-butylphthalate	UG/L	10	0	0%				
Di-n-octylphthalate	UG/L	10	0	0%				
Dibenz(a,h)anthracene	UG/L	10	0	0%				
Dibenzofuran	UG/L	10	0	0%				
Diethylphthalate	UG/L	10	0	0%				
Dimethylphthalate	UG/L	10	0	0%				
Fluoranthene	UG/L	10	0	0%				

Table 4-42
SEAD-17 Summary Statistics for Surface Water Samples

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
Fluorene	UG/L	10	0	0%				
Hexachlorobenzene	UG/L	10	0	0%				
Hexachlorobutadiene	UG/L	10	0	0%				
Hexachlorocyclopentadiene	UG/L	10	0	0%				
Hexachloroethane	UG/L	10	0	0%				
Indeno(1,2,3-cd)pyrene	UG/L	10	0	0%				
Isophorone	UG/L	10	0	0%				
N-Nitroso-di-n-propylamine	UG/L	10	0	0%				
N-Nitrosodiphenylamine (1)	UG/L	10	0	0%				
Naphthalene	UG/L	10	0	0%				
Nitrobenzene	UG/L	10	0	0%				
Pentachlorophenol	UG/L	10	0	0%				
Phenanthrene	UG/L	10	0	0%				
Phenol	UG/L	10	0	0%				
Pyrene	UG/L	10	0	0%				
bis(2-Chloroethoxy) methane	UG/L	10	0	0%				
bis(2-Chloroethyl) ether	UG/L	10	0	0%				
bis(2-Chloroisopropyl) ether	UG/L	10	0	0%				
bis(2-Ethylhexyl)phthalate	UG/L	10	2	20%	1	2	1.5	0.707
PESTICIDES/PCB								
4,4'-DDD	UG/L	10	0	0%				
4,4'-DDE	UG/L	10	0	0%				
4,4'-DDT	UG/L	10	0	0%				
Aldrin	UG/L	10	0	0%				
Aroclor-1016	UG/L	10	0	0%				
Aroclor-1221	UG/L	10	0	0%				
Aroclor-1232	UG/L	10	0	0%				
Aroclor-1242	UG/L	10	0	0%				
Aroclor-1248	UG/L	10	0	0%				
Aroclor-1254	UG/L	10	0	0%				
Aroclor-1260	UG/L	10	0	0%				
Dieldrin	UG/L	10	0	0%				
Endosulfan I	UG/L	10	0	0%				
Endosulfan II	UG/L	10	0	0%				
Endosulfan sulfate	UG/L	10	0	0%				
Endrin	UG/L	10	0	0%				
Endrin aldehyde	UG/L	10	0	0%				
Endrin ketone	UG/L	10	0	0%				
Heptachlor	UG/L	10	0	0%				
Heptachlor epoxide	UG/L	10	0	0%				

Table 4-42
SEAD-17 Summary Statistics for Surface Water Samples

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
Methoxychlor	UG/L	10	0	0%				
Toxaphene	UG/L	10	0	0%				
alpha-BHC	UG/L	10	0	0%				
alpha-Chlordane	UG/L	10	0	0%				
beta-BHC	UG/L	10	0	0%				
delta-BHC	UG/L	10	0	0%				
gamma-BHC (Lindane)	UG/L	10	0	0%				
gamma-Chlordane	UG/L	10	0	0%				
OTHER ANALYSES								
Nitrate/Nitrite-Nitrogen	MG/L	10	0	0%				
Percent Solids (Metals)		10	10	100%	0	0	0	0
Total Organic Carbon	MG/L	10	10	100%	3.8	11.6	7.5	2.77
pH	MG/L	10	10	100%	7.43	7.89	7.646	0.181
NITROAROMATICS								
1,3,5-Trinitrobenzene	UG/L	20	0	0%				
1,3-Dinitrobenzene	UG/L	20	0	0%				
2,4,6-Trinitrotoluene	UG/L	20	0	0%				
2,4-Dinitrotoluene	UG/L	20	0	0%				
2,6-Dinitrotoluene	UG/L	20	0	0%				
2-Nitrotoluene	UG/L	10	0	0%				
2-amino-4,6-Dinitrotoluene	UG/L	20	0	0%				
3-Nitrotoluene	UG/L	10	0	0%				
4-Nitrotoluene	UG/L	10	0	0%				
4-amino-2,6-Dinitrotoluene	UG/L	20	0	0%				
HMX	UG/L	20	0	0%				
Nitrobenzene	UG/L	20	0	0%				
RDX	UG/L	20	0	0%				
Tetryl	UG/L	20	0	0%				
METALS								
Aluminum	UG/L	10	0	0%				
Antimony	UG/L	10	4	40%	4.1	23.6	11.425	8.936
Arsenic	UG/L	10	6	60%	2.9	4.6	3.733	0.606
Barium	UG/L	10	10	100%	16	100	47.01	27.322
Beryllium	UG/L	10	0	0%				
Cadmium	UG/L	10	5	50%	0.32	1.3	0.632	0.389
Calcium	UG/L	10	10	100%	29300	73500	53640	16622.76
Chromium	UG/L	10	1	10%	1	1	1	0
Cobalt	UG/L	10	0	0%				
Copper	UG/L	10	10	100%	6.7	32.7	13.04	8.079
Cyanide	UG/L	10	0	0%				

Table 4-42
SEAD-17 Summary Statistics for Surface Water Samples

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
Iron	UG/L	10	10	100%	48.5	322	146.3	82.062
Lead	UG/L	10	6	60%	1.8	37.1	11.45	13.591
Magnesium	UG/L	10	10	100%	2610	9280	5904	2882.727
Manganese	UG/L	10	10	100%	1.4	19.6	8.43	6.2
Mercury	UG/L	10	0	0%				
Nickel	UG/L	10	1	10%	1.7	1.7	1.7	0
Potassium	UG/L	10	10	100%	1980	4380	3007	896.562
Selenium	UG/L	10	5	50%	2.5	3.5	3.14	0.428
Silver	UG/L	10	0	0%				
Sodium	UG/L	10	10	100%	1600	9460	5209	3180.651
Thallium	UG/L	10	0	0%				
Vanadium	UG/L	10	1	10%	1.8	1.8	1.8	0
Zinc	UG/L	10	10	100%	2.8	61.7	24.13	21.177

Table 4-43
SEAD-17 Summary of Analytes Detected in Surface Water

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SW/SD17-1		SW/SD17-10		SW/SD17-2		SW/SD17-3	
			SAMP ID:	16120		16123		16130		16131	
			QC CODE:	SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:								
			BOTTOM:								
			MATRIX:	SURFACE WATER		SURFACE WATER		SURFACE WATER		SURFACE WATER	
			SAMPLE DATE:	9/17/96		9/17/96		9/18/96		9/18/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
SEMIVOLATILE ORGANICS											
bis(2-Ethylhexyl)phthalate	0.6	NYS AWQS CLASS C	UG/L	10	U	10	U	10	U	2	J
OTHER ANALYSES											
Percent Solids (Metals)				0		0		0		0	
Total Organic Carbon			MG/L	7.3		11.6		8.4		3.9	
pH			MG/L	7.87		7.44		7.81		7.81	
METALS											
Antimony			UG/L	5.4	J	2	U	4.1	J	12.6	J
Arsenic	190	NYS AWQS CLASS C	UG/L	2.7	U	3.9	J	2.7	U	4.6	J
Barium			UG/L	42.6	J	30.4	J	43.6	J	91.8	J
Cadmium	1.86	NYS AWQS CLASS C	UG/L	0.32	J	0.3	U	0.47	J	0.63	J
Calcium			UG/L	46400		50100		48300		68200	
Chromium	347.27	NYS AWQS CLASS C	UG/L	1	J	1	U	1	U	1	U
Copper	20.29	NYS AWQS CLASS C	UG/L	18.4		17.4		12.6		9.5	
Iron	300	NYS AWQS CLASS C	UG/L	**322**	**J**	81.1	J	174	J	169	J
Lead	7.16	NYS AWQS CLASS C	UG/L	**14.9**		1.8		**9.7**		3.3	
Magnesium			UG/L	3810		3430		6390		8730	
Manganese			UG/L	6.6		2.7		16		8.8	
Nickel	154.49	NYS AWQS CLASS C	UG/L	1.6	U	1.6	U	1.7		1.6	U
Potassium			UG/L	3270		3830		2470		4380	
Selenium	1	NYS AWQS CLASS C	UG/L	2.4	U	2.4	U	**3.4**	**J**	**3.5**	**J**
Sodium			UG/L	3090		2990		2880		5830	

Note: Shaded values exceed the NYS AWQS Class C.

Table 4-43
SEAD-17 Summary of Analytes Detected in Surface Water

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SW/SD17-1		SW/SD17-10		SW/SD17-2		SW/SD17-3	
			SAMP ID:	16120		16123		16130		16131	
			QC CODE:	SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:								
			BOTTOM:								
			MATRIX:	SURFACE WATER		SURFACE WATER		SURFACE WATER		SURFACE WATER	
			SAMPLE DATE:	9/17/96		9/17/96		9/18/96		9/18/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Vanadium	14	NYS AWQS CLASS C	UG/L	1.8	J	1.2	U	1.2	U	1.2	U
Zinc	141.38	NYS AWQS CLASS C	UG/L	20.9		50.5		40.8		29.1	
	t										

Note: Shaded values exceed the NYS AWQS Class C.

Table 4-43
SEAD-17 Summary of Analytes Detected in Surface Water

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SW/SD17-4		SW/SD17-5		SW/SD17-6		SW/SD17-7		SW/SD17-8
			SAMP ID:	16136		16137		16121		16132		16124
			QC CODE:	SA		SA		SA		SA		SA
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1
			TOP:									
			BOTTOM:									
			MATRIX:	SURFACE WATER		SURFACE WATER		SURFACE WATER		SURFACE WATER		SURFACE WATER
			SAMPLE DATE:	9/18/96		9/18/96		9/18/96		9/18/96		9/17/96
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE
SEMIVOLATILE ORGANICS												
bis(2-Ethylhexyl)phthalate	0.6	NYS AWQS CLASS C	UG/L	10	U	10	U	10	U	1	J	10
OTHER ANALYSES												
Percent Solids (Metals)				0		0		0		0		0
Total Organic Carbon			MG/L	6.1		6.8		3.8		5.9		11.1
pH			MG/L	7.43		7.52		7.62		7.53		7.89
METALS												
Antimony			UG/L	2	U	2	U	2	U	23.6	J	2
Arsenic	190	NYS AWQS CLASS C	UG/L	2.9	J	2.7	U	2.7	U	3.8	J	4
Barium			UG/L	41.7	J	40.5	J	38.8	J	100	J	16
Cadmium	1.86	NYS AWQS CLASS C	UG/L	0.44	J	0.3	U	0.3	U	1.3	J	0.3
Calcium			UG/L	73500		72900		71800		38800		29300
Chromium	347.27	NYS AWQS CLASS C	UG/L	1	U	1	U	1	U	1	U	1
Copper	20.29	NYS AWQS CLASS C	UG/L	6.9		6.8		6.7		**32.7**		10.5
Iron	300	NYS AWQS CLASS C	UG/L	134	J	141	J	112	J	222	J	59.4
Lead	7.16	NYS AWQS CLASS C	UG/L	1.9		1.7	U	1.7	U	**37.1**		1.7
Magnesium			UG/L	9280		9160		8990		3730		2610
Manganese			UG/L	13.3		19.6		4.7		9.1		1.4
Nickel	154.49	NYS AWQS CLASS C	UG/L	1.6	U	1.6	U	1.6	U	1.6	U	1.6
Potassium			UG/L	1980		2020		1990		3700		2630
Selenium	1	NYS AWQS CLASS C	UG/L	**2.5**	**J**	**2.9**	**J**	2.4	U	**3.4**	**J**	2.4
Sodium			UG/L	9460		9260		8950		6410		1600

Note: Shaded values exceed the NYS AWQS Class C.

Table 4-43
SEAD-17 Summary of Analytes Detected in Surface Water

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SW/SD17-4		SW/SD17-5		SW/SD17-6		SW/SD17-7		SW/SD17-8
			SAMP ID:	16136		16137		16121		16132		16124
			QC CODE:	SA		SA		SA		SA		SA
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1
			TOP:									
			BOTTOM:									
			MATRIX:	SURFACE WATER		SURFACE WATER		SURFACE WATER		SURFACE WATER		SURFACE WATER
			SAMPLE DATE:	9/18/96		9/18/96		9/18/96		9/18/96		9/17/96
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE
Vanadium	14	NYS AWQS CLASS C	UG/L	1.2	U	1.2	U	1.2	U	1.2	U	1.2
Zinc	141.38	NYS AWQS CLASS C	UG/L	3.6		3.3		2.8		61.7		6.8
	t											

Note: Shaded values exceed the NYS AWQS Class C.

Table 4-43
SEAD-17 Summary of Analytes Detected in Surface Water

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:		SW/SD17-9	
			SAMP ID:		16122	
			QC CODE:		SA	
			STUDY ID:		RI ROUND1	
			TOP:			
			BOTTOM:			
			MATRIX:		SURFACE WATER	
			SAMPLE DATE:		9/17/96	
PARAMETER	LEVEL	SOURCE	UNIT	Q	VALUE	Q
SEMIVOLATILE ORGANICS						
bis(2-Ethylhexyl)phthalate	0.6	NYS AWQS CLASS C	UG/L	U	10	U
OTHER ANALYSES						
Percent Solids (Metals)					0	
Total Organic Carbon			MG/L		10.1	
pH			MG/L		7.54	
METALS						
Antimony			UG/L	U	2	U
Arsenic	190	NYS AWQS CLASS C	UG/L	J	3.2	J
Barium			UG/L	J	24.7	J
Cadmium	1.86	NYS AWQS CLASS C	UG/L	U	0.3	U
Calcium			UG/L		37100	
Chromium	347.27	NYS AWQS CLASS C	UG/L	U	1	U
Copper	20.29	NYS AWQS CLASS C	UG/L		8.9	
Iron	300	NYS AWQS CLASS C	UG/L	J	48.5	J
Lead	7.16	NYS AWQS CLASS C	UG/L	U	1.7	U
Magnesium			UG/L		2910	
Manganese			UG/L		2.1	
Nickel	154.49	NYS AWQS CLASS C	UG/L	U	1.6	U
Potassium			UG/L		3800	
Selenium	1	NYS AWQS CLASS C	UG/L	U	2.4	U
Sodium			UG/L		1620	

Note: Shaded values exceed the NYS AWQS Class C.

Table 4-43
SEAD-17 Summary of Analytes Detected in Surface Water

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:		SW/SD17-9	
			SAMP ID:		16122	
			QC CODE:		SA	
			STUDY ID:		RI ROUND1	
			TOP:			
			BOTTOM:			
			MATRIX:		SURFACE WATER	
			SAMPLE DATE:		9/17/96	
PARAMETER	LEVEL	SOURCE	UNIT	Q	VALUE	Q
Vanadium	14	NYS AWQS CLASS C	UG/L	U	1.2	U
Zinc	141.38	NYS AWQS CLASS C	UG/L		21.8	
	t					

Note: Shaded values exceed the NYS AWQS Class C.

Table 4-44

VOCs and TICs in Surface Water (ug/L)

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Surface Water Sampling Location	Surface Water Sample ID	Study ID	Total TCL VOCs	Total TICs	Total All VOCs
SW/SD17-1	16120	Round I	0	0	0
SW/SD17-2	16130	Round I	0	0	0
SW/SD17-3	16131	Round I	0	0	0
SW/SD17-4	16136	Round I	0	0	0
SW/SD17-5	16137	Round I	0	0	0
SW/SD17-6	16121	Round I	0	5	5
SW/SD17-7	16132	Round I	0	0	0
SW/SD17-8	16124	Round I	0	0	0
SW/SD17-9	16122	Round I	0	0	0
SW/SD17-10	16123	Round I	0	0	0

Table 4-45

SVOCs and TICs in Surface Water (ug/L)

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Surface Water Sampling Location	Surface Water Sample ID	Study ID	Total TCL SVOCs	Total TICs	Total All SVOCs
SW/SD17-1	16120	Round I	0	4	4
SW/SD17-2	16130	Round I	0	13	13
SW/SD17-3	16131	Round I	2	29	31
SW/SD17-4	16136	Round I	0	16	16
SW/SD17-5	16137	Round I	0	9	9
SW/SD17-6	16121	Round I	0	7	7
SW/SD17-7	16132	Round I	1	5	6
SW/SD17-8	16124	Round I	0	0	0
SW/SD17-9	16122	Round I	0	2	2
SW/SD17-10	16123	Round I	0	0	0

at concentrations above the Class C standard of 1 µg/L. A maximum concentration of 3.5 µg/L was detected in SW/SD17-3. Several of the maximum concentrations of the metals were detected in the surface water sample SW/SD17-3, which is located in the drainage ditch south of the Deactivation Furnace. Figure 4-14 shows the distribution of copper and lead in surface water locations.

The detection limit for selenium (2.4 µg/L) exceeded the NYS Class C Standard of 1 µg/L.

4.2.4.7 Other Constituents

Nitrate/Nitrite-Nitrogen

Nitrate/nitrite-nitrogen was not detected in any of the surface water samples collected at SEAD-17.

4.2.5 Sediment

For the purposes of the discussion of criteria exceedences below, sediment results were compared to the lowest of several applicable New York State guidelines for sediment. These standards included: the lowest effect level (NYS LEL), human health bioaccumulation criteria (NYS HHB), benthic aquatic life acute toxicity criteria (NYS BALAT) and benthic aquatic life chronic toxicity criteria (NYS BALCT), and wildlife bioaccumulation criteria (NYS WB). The criteria were calculated based on an average organic carbon content of 1.23% in the sediment.

Summary statistics for the sediment analyses are shown in Table 4-46.

4.2.5.1 Volatile Organic Compounds

The two VOC compounds acetone and toluene were detected in three of the ten sediment samples (Table 4-47). However, because these compounds appear in laboratory blanks, they are likely laboratory contaminants and are not believed to be representative of the true sediment chemistry at SEAD-17.

VOC TICs were detected at one sediment location (Table 4-48). SW/SD17-6 contained a TIC concentration of 23 µg/kg.

4.2.5.2 Semivolatile Organic Compounds

Thirteen SVOCs (PAHs, phenols, and phthalates) were detected in four of the ten sediment samples at SEAD-17. Six PAH compounds were detected in only one sediment sample SW/SD17-8 at concentrations above their respective NYS HHB criteria values.

Five of the PAHs are considered to be carcinogenic. At SW/SD17-8, which was collected from the ditch in the northeastern corner of the site, the total carcinogenic PAH level was 179 J µg/kg.

The compounds 2,4-dimethylphenol was detected in one sample, SW/SD17-1. Also, bis(2-ethylhexyl)phthalate was detected in three samples at a maximum concentration of 77 µg/kg, which was far below the NYS BALCT of 2,460 µg/kg.

Detection limits for the compounds benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene exceeded the NYS HHB criteria value for the six compounds (15.99 µg/kg).

SVOC TICs were detected in all of the sediment locations at SEAD-17 (Table 4-49). The two locations with the highest TIC concentrations are located in the drainage ditch in the western portion of the site. SW/SD17-5 and SW/SD17-4 contained concentrations of 27,840 µg/kg and 20,920 µg/kg, respectively.

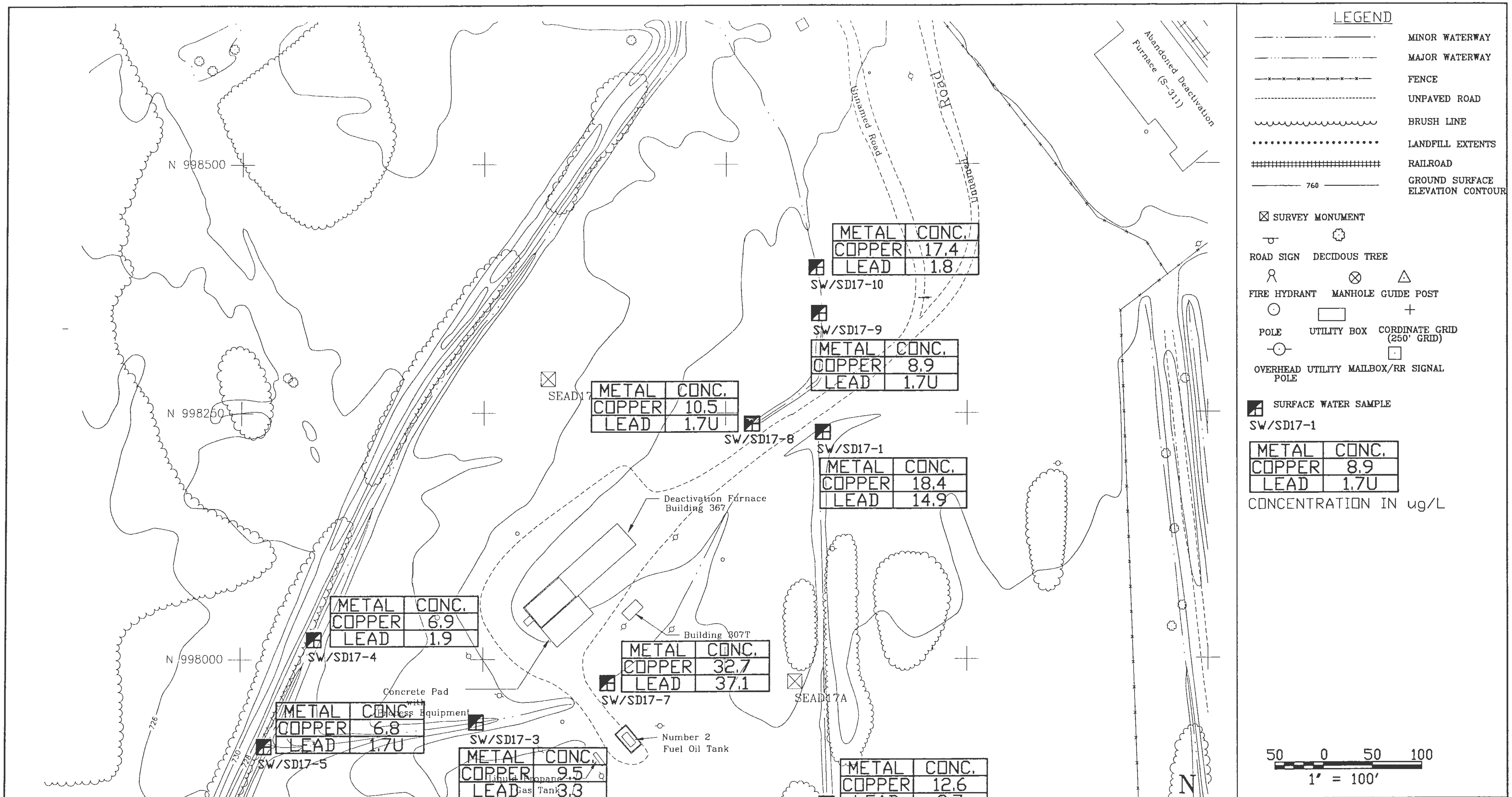
4.2.5.3 Pesticide and PCBs

A total of six pesticides were detected in the sediment samples at SEAD-17 (Table 4-47). No PCBs were detected. All six of the pesticides (4,4'-DDD, 4,4'-DDE, 4,4'-DDT, Dieldrin, Endosulfan I, and Endosulfan II) exceeded their respective sediment criteria values; the exceedences occurred in six of the ten samples. Exceedences were detected in samples SW/SD17-4, SW/SD17-5, and SW/SD17-6, which are located in the drainage ditch west of the site, and in samples SW/SD17-8, SW/SD17-9, and SW/SD17-10, which are located in the drainage ditch in the northeastern corner of the site.

The detection limits for all six compounds exceeded their respective NYS HHB or BALCT criteria values, which were low values of 1.23 µg/kg or less.

4.2.5.4 Nitroaromatics

No nitroaromatic compounds were detected in the sediment samples collected from SEAD-17.



PARSONS

PARSONS ENGINEERING SCIENCE, INC.

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT ACTIVITY
RI/FS
SEAD-17 ACTIVE DEACTIVATION FURNACE

DEPT.	Dwg No.
ENVIRONMENTAL ENGINEERING	729895-01001

FIGURE 4-14
SEAD-17 METALS IN
SURFACE WATER SAMPLES

SCALE	DATE	REV
1" = 100'	DECEMBER 1996	A

Table 4-46
SEAD-17 Summary Statistics for Sediment Samples

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
VOLATILE ORGANICS								
1,1,1-Trichloroethane	UG/KG	10	0	0%				
1,1,2,2-Tetrachloroethane	UG/KG	10	0	0%				
1,1,2-Trichloroethane	UG/KG	10	0	0%				
1,1-Dichloroethane	UG/KG	10	0	0%				
1,1-Dichloroethene	UG/KG	10	0	0%				
1,2-Dichloroethane	UG/KG	10	0	0%				
1,2-Dichloroethene (total)	UG/KG	10	0	0%				
1,2-Dichloropropane	UG/KG	10	0	0%				
2-Butanone	UG/KG	10	0	0%				
2-Hexanone	UG/KG	10	0	0%				
4-Methyl-2-Pentanone	UG/KG	10	0	0%				
Acetone	UG/KG	10	3	30%	10	26	17	8.185
Benzene	UG/KG	10	0	0%				
Bromodichloromethane	UG/KG	10	0	0%				
Bromoform	UG/KG	10	0	0%				
Bromomethane	UG/KG	10	0	0%				
Carbon Disulfide	UG/KG	10	0	0%				
Carbon Tetrachloride	UG/KG	10	0	0%				
Chlorobenzene	UG/KG	10	0	0%				
Chloroethane	UG/KG	10	0	0%				
Chloroform	UG/KG	10	0	0%				
Chloromethane	UG/KG	10	0	0%				
Dibromochloromethane	UG/KG	10	0	0%				
Ethylbenzene	UG/KG	10	0	0%				
Methylene Chloride	UG/KG	10	0	0%				
Styrene	UG/KG	10	0	0%				
Tetrachloroethene	UG/KG	10	0	0%				
Toluene	UG/KG	10	1	10%	8	8	8	0
Trichloroethene	UG/KG	10	0	0%				
Vinyl Chloride	UG/KG	10	0	0%				
Xylene (total)	UG/KG	10	0	0%				
cis-1,3-Dichloropropene	UG/KG	10	0	0%				
trans-1,3-Dichloropropene	UG/KG	10	0	0%				
SEMIVOLATILE ORGANICS								
1,2,4-Trichlorobenzene	UG/KG	10	0	0%				
1,2-Dichlorobenzene	UG/KG	10	0	0%				
1,3-Dichlorobenzene	UG/KG	10	0	0%				
1,4-Dichlorobenzene	UG/KG	10	0	0%				
2,4,5-Trichlorophenol	UG/KG	10	0	0%				

Table 4-46
SEAD-17 Summary Statistics for Sediment Samples

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
2,4,6-Trichlorophenol	UG/KG	10	0	0%				
2,4-Dichlorophenol	UG/KG	10	0	0%				
2,4-Dimethylphenol	UG/KG	10	1	10%	32	32	32	0
2,4-Dinitrophenol	UG/KG	10	0	0%				
2,4-Dinitrotoluene	UG/KG	10	1	10%	450	450	450	0
2,6-Dinitrotoluene	UG/KG	10	0	0%				
2-Chloronaphthalene	UG/KG	10	0	0%				
2-Chlorophenol	UG/KG	10	0	0%				
2-Methylnaphthalene	UG/KG	10	0	0%				
2-Methylphenol	UG/KG	10	0	0%				
2-Nitroaniline	UG/KG	10	0	0%				
2-Nitrophenol	UG/KG	10	0	0%				
3,3'-Dichlorobenzidine	UG/KG	10	0	0%				
3-Nitroaniline	UG/KG	10	0	0%				
4,6-Dinitro-2-methylphenol	UG/KG	10	0	0%				
4-Bromophenyl-phenylether	UG/KG	10	0	0%				
4-Chloro-3-methylphenol	UG/KG	10	0	0%				
4-Chloroaniline	UG/KG	10	0	0%				
4-Chlorophenyl-phenylether	UG/KG	10	0	0%				
4-Methylphenol	UG/KG	10	0	0%				
4-Nitroaniline	UG/KG	10	0	0%				
4-Nitrophenol	UG/KG	10	0	0%				
Acenaphthene	UG/KG	10	0	0%				
Acenaphthylene	UG/KG	10	0	0%				
Anthracene	UG/KG	10	0	0%				
Benzo(a)anthracene	UG/KG	10	1	10%	25	25	25	0
Benzo(a)pyrene	UG/KG	10	1	10%	30	30	30	0
Benzo(b)fluoranthene	UG/KG	10	1	10%	43	43	43	0
Benzo(g,h,i)perylene	UG/KG	10	1	10%	31	31	31	0
Benzo(k)fluoranthene	UG/KG	10	1	10%	33	33	33	0
Butylbenzylphthalate	UG/KG	10	0	0%				
Carbazole	UG/KG	10	0	0%				
Chrysene	UG/KG	10	1	10%	48	48	48	0
Di-n-butylphthalate	UG/KG	10	0	0%				
Di-n-octylphthalate	UG/KG	10	0	0%				
Dibenz(a,h)anthracene	UG/KG	10	0	0%				
Dibenzofuran	UG/KG	10	0	0%				
Diethylphthalate	UG/KG	10	0	0%				
Dimethylphthalate	UG/KG	10	0	0%				
Fluoranthene	UG/KG	10	2	20%	36	70	53	24.042

Table 4-46
SEAD-17 Summary Statistics for Sediment Samples

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
Fluorene	UG/KG	10	0	0%				
Hexachlorobenzene	UG/KG	10	0	0%				
Hexachlorobutadiene	UG/KG	10	0	0%				
Hexachlorocyclopentadiene	UG/KG	10	0	0%				
Hexachloroethane	UG/KG	10	0	0%				
Indeno(1,2,3-cd)pyrene	UG/KG	10	1	10%	24	24	24	0
Isophorone	UG/KG	10	0	0%				
N-Nitroso-di-n-propylamine	UG/KG	10	0	0%				
N-Nitrosodiphenylamine (1)	UG/KG	10	0	0%				
Naphthalene	UG/KG	10	0	0%				
Nitrobenzene	UG/KG	10	0	0%				
Pentachlorophenol	UG/KG	10	0	0%				
Phenanthrene	UG/KG	10	1	10%	35	35	35	0
Phenol	UG/KG	10	0	0%				
Pyrene	UG/KG	10	2	20%	26	47	36.5	14.849
bis(2-Chloroethoxy) methane	UG/KG	10	0	0%				
bis(2-Chloroethyl) ether	UG/KG	10	0	0%				
bis(2-Chloroisopropyl) ether	UG/KG	10	0	0%				
bis(2-Ethylhexyl)phthalate	UG/KG	10	3	30%	36	77	55.667	20.551
PESTICIDES/PCB								
4,4'-DDD	UG/KG	10	3	30%	3.2	13	8	4.903
4,4'-DDE	UG/KG	10	6	60%	2.8	62	19.2	22.994
4,4'-DDT	UG/KG	10	2	20%	3	12	7.5	6.364
Aldrin	UG/KG	10	0	0%				
Aroclor-1016	UG/KG	10	0	0%				
Aroclor-1221	UG/KG	10	0	0%				
Aroclor-1232	UG/KG	10	0	0%				
Aroclor-1242	UG/KG	10	0	0%				
Aroclor-1248	UG/KG	10	0	0%				
Aroclor-1254	UG/KG	10	0	0%				
Aroclor-1260	UG/KG	10	0	0%				
Dieldrin	UG/KG	10	1	10%	5	5	5	0
Endosulfan I	UG/KG	10	1	10%	1.6	1.6	1.6	0
Endosulfan II	UG/KG	10	2	20%	3.7	3.8	3.75	0.071
Endosulfan sulfate	UG/KG	10	0	0%				
Endrin	UG/KG	10	0	0%				
Endrin aldehyde	UG/KG	10	0	0%				
Endrin ketone	UG/KG	10	0	0%				
Heptachlor	UG/KG	10	0	0%				
Heptachlor epoxide	UG/KG	10	0	0%				

Table 4-46
SEAD-17 Summary Statistics for Sediment Samples

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
Methoxychlor	UG/KG	10	0	0%				
Toxaphene	UG/KG	10	0	0%				
alpha-BHC	UG/KG	10	0	0%				
alpha-Chlordane	UG/KG	10	0	0%				
beta-BHC	UG/KG	10	0	0%				
delta-BHC	UG/KG	10	0	0%				
gamma-BHC (Lindane)	UG/KG	10	0	0%				
gamma-Chlordane	UG/KG	10	0	0%				
OTHER ANALYSES								
Nitrate/Nitrite-Nitrogen	MG/KG	10	10	100%	0.02	0.24	0.077	0.062
Percent Moisture (PEST/PCB)		10	10	100%	23	46	33.8	7.208
Percent Moisture (SVOCs)		10	10	100%	23	46	34.8	7.005
Percent Moisture (VOCs)		10	10	100%	23	51	31.6	9.935
Percent Solids (Metals)		10	10	100%	53.9	76.8	66.09	7.176
Total Organic Carbon	MG/KG	10	9	90%	4090	36100	12327.78	9852.676
NITROAROMATICS								
1,3,5-Trinitrobenzene	UG/KG	10	0	0%				
1,3-Dinitrobenzene	UG/KG	10	0	0%				
2,4,6-Trinitrotoluene	UG/KG	10	0	0%				
2,4-Dinitrotoluene	UG/KG	10	0	0%				
2,6-Dinitrotoluene	UG/KG	10	0	0%				
2-Nitrotoluene	UG/KG	10	0	0%				
2-amino-4,6-Dinitrotoluene	UG/KG	10	0	0%				
3-Nitrotoluene	UG/KG	10	0	0%				
4-Nitrotoluene	UG/KG	10	0	0%				
4-amino-2,6-Dinitrotoluene	UG/KG	10	0	0%				
HMX	UG/KG	10	0	0%				
Nitrobenzene	UG/KG	10	0	0%				
RDX	UG/KG	10	0	0%				
Tetryl	UG/KG	10	0	0%				
METALS								
Aluminum	MG/KG	10	10	100%	11400	22100	16370	3287.028
Antimony	MG/KG	10	4	40%	1.6	5.5	3.45	1.94
Arsenic	MG/KG	10	10	100%	3.3	7.5	5.29	1.405
Barium	MG/KG	10	10	100%	51.1	162	111.77	34.514
Beryllium	MG/KG	10	10	100%	0.26	0.99	0.642	0.213
Cadmium	MG/KG	10	10	100%	0.25	4.8	1.573	1.448
Calcium	MG/KG	10	10	100%	1950	25000	6031	6852.533
Chromium	MG/KG	10	10	100%	13.7	27.7	22.16	4.368
Cobalt	MG/KG	10	10	100%	5.8	17.8	10.81	3.041

Table 4-46
SEAD-17 Summary Statistics for Sediment Samples

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Parameter	Units	Total Count	Hit Count	Frequency	Min. Conc.	Max. Conc.	Average	Standard Deviation
Copper	MG/KG	10	10	100%	26	309	73.32	85.855
Cyanide	MG/KG	10	0	0%				
Iron	MG/KG	10	10	100%	17400	35000	26540	5054.635
Lead	MG/KG	10	10	100%	68.3	1050	270.32	329.896
Magnesium	MG/KG	10	10	100%	2250	6490	4890	1127.987
Manganese	MG/KG	10	10	100%	275	768	445.1	151.769
Mercury	MG/KG	10	4	40%	0.04	0.16	0.078	0.057
Nickel	MG/KG	10	10	100%	10.8	31.6	27.2	6.366
Potassium	MG/KG	10	10	100%	1250	2630	1899	499.098
Selenium	MG/KG	10	3	30%	0.96	1.9	1.487	0.48
Silver	MG/KG	10	0	0%				
Sodium	MG/KG	10	8	80%	69	452	214	163.732
Thallium	MG/KG	10	2	20%	1	1.3	1.15	0.212
Vanadium	MG/KG	10	10	100%	18.8	33.8	26.77	5.196
Zinc	MG/KG	10	10	100%	57.6	278	130.03	73.599

Table 4-47
SEAD-17 Summary of Analytes Detected in Sediment

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SW/SD17-1		SW/SD17-10		SW/SD17-2		SW/SD17-3		SW/SD17-4	
			SAMP ID:	16120A		16123A		16130A		16131A		16136A	
			QC CODE:	SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0	
			BOTTOM:	6		6		6		6		6	
			MATRIX:	SEDIMENT		SEDIMENT		SEDIMENT		SEDIMENT		SEDIMENT	
			SAMPLE DATE:	9/17/96		9/17/96		9/18/96		9/18/96		9/18/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
VOLATILE ORGANICS													
Acetone			UG/KG	15		13	U	14	U	15	U	20	U
Toluene			UG/KG	14	U	13	U	14	U	14	U	20	U
SEMIVOLATILE ORGANICS													
2,4-Dimethylphenol			UG/KG	32	J	430	U	530	U	480	U	610	U
2,4-Dinitrotoluene			UG/KG	460	U	430	U	530	U	480	U	610	U
Benzo(a)anthracene	15.99	NYS HHB	UG/KG	460	U	430	U	530	U	480	U	610	U
Benzo(a)pyrene	15.99	NYS HHB	UG/KG	460	U	430	U	530	U	480	U	610	U
Benzo(b)fluoranthene	15.99	NYS HHB	UG/KG	460	U	430	U	530	U	480	U	610	U
Benzo(g,h,i)perylene			UG/KG	460	U	430	U	530	U	480	U	610	U
Benzo(k)fluoranthene	15.99	NYS HHB	UG/KG	460	U	430	U	530	U	480	U	610	U
Chrysene	15.99	NYS HHB	UG/KG	460	U	430	U	530	U	480	U	610	U
Fluoranthene	12546	NSY BALCT	UG/KG	460	U	36	J	530	U	480	U	610	U
Indeno(1,2,3-cd)pyrene	15.99	NYS HHB	UG/KG	460	U	430	U	530	U	480	U	610	U
Phenanthrene	1476	NSY BALCT	UG/KG	460	U	430	U	530	U	480	U	610	U
Pyrene			UG/KG	460	U	26	J	530	U	480	U	610	U
bis(2-Ethylhexyl)phthalate	2460	NSY BALCT	UG/KG	54	J	430	U	530	U	480	U	36	J
PESTICIDES/PCB													
4,4'-DDD	0.123	NYS HHB	UG/KG	4.6	U	4.3	U	4.6	U	4.9	U	**7.8**	

Note: Shaded values exceed NYS HHB, BALCT, LEL.

Table 4-47
SEAD-17 Summary of Analytes Detected in Sediment

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SW/SD17-1		SW/SD17-10		SW/SD17-2		SW/SD17-3		SW/SD17-4	
			SAMP ID:	16120A		16123A		16130A		16131A		16136A	
			QC CODE:	SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0	
			BOTTOM:	6		6		6		6		6	
			MATRIX:	SEDIMENT		SEDIMENT		SEDIMENT		SEDIMENT		SEDIMENT	
			SAMPLE DATE:	9/17/96		9/17/96		9/18/96		9/18/96		9/18/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
4,4'-DDE	0.123	NYS HHB	UG/KG	4.6	U	**2.8**	**J**	4.6	U	4.9	U	**28**	
4,4'-DDT	0.123	NYS HHB	UG/KG	4.6	U	4.3	U	4.6	U	4.9	U	6.1	U
Dieldrin	1.23	NYS HHB	UG/KG	4.6	U	**5**		4.6	U	4.9	U	6.1	U
Endosulfan I	0.369	NSY BALCT	UG/KG	2.4	U	2.2	U	2.4	U	2.5	U	3.1	U
Endosulfan II	0.369	NSY BALCT	UG/KG	4.6	U	4.3	U	4.6	U	4.9	U	**3.8**	**J**
OTHER ANALYSES													
Nitrate/Nitrite-Nitrogen			MG/KG	0.04		0.05		0.06		0.07		0.24	
Percent Moisture (PEST/PCB)				29		23		28		32		46	
Percent Moisture (SVOCs)				29		23		38		32		46	
Percent Moisture (VOCs)				26		23		28		26		49	
Percent Solids (Metals)				70.8		76.8		72		67.8		53.9	
Total Organic Carbon			MG/KG	141	U	10700		5650		10000		12800	
METALS													
Aluminum			MG/KG	18900		12100		19600		11400		16600	
Antimony	2	NYS LEL	MG/KG	0.61	UJ	0.84	UJ	1.6	J	**5.5**	**J**	**2**	**J**
Arsenic	6	NYS LEL	MG/KG	**6.2**		3.3		**7.3**		4.5		4.1	
Barium			MG/KG	128		51.1		162		121		106	
Beryllium			MG/KG	0.99		0.26		0.86		0.57		0.67	
Cadmium	0.6	NYS LEL	MG/KG	0.32		0.28		**1.1**		**4.8**		**2.4**	

Note: Shaded values exceed NYS HHB, BALCT, LEL.

Table 4-47
SEAD-17 Summary of Analytes Detected in Sediment

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SW/SD17-1		SW/SD17-10		SW/SD17-2		SW/SD17-3		SW/SD17-4	
			SAMP ID:	16120A		16123A		16130A		16131A		16136A	
			QC CODE:	SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0	
			BOTTOM:	6		6		6		6		6	
			MATRIX:	SEDIMENT		SEDIMENT		SEDIMENT		SEDIMENT		SEDIMENT	
			SAMPLE DATE:	9/17/96		9/17/96		9/18/96		9/18/96		9/18/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Calcium			MG/KG	4100		1950		3790		25000		6860	
Chromium	26	NYS LEL	MG/KG	25.8		13.7		25.4		16.3		23.5	
Cobalt			MG/KG	11.5		5.8		10.7		8.4		9.9	
Copper	16	NYS LEL	MG/KG	**38.6**	**J**	**27.1**	**J**	**42**	**J**	**98.1**	**J**	**75.3**	**J**
Iron	20000	NYS LEL	MG/KG	**30800**		17400		**27800**		**20700**		**24500**	
Lead	31	NYS LEL	MG/KG	**68.3**		**72.9**		**166**		**1050**		**258**	
Magnesium			MG/KG	4970		2250		5140		6490		5780	
Manganese	460	NYS LEL	MG/KG	**566**	**J**	362	J	348	J	415	J	275	
Mercury	0.15	NYS LEL	MG/KG	0.04		0.03	U	0.04	U	0.03	U	**0.16**	
Nickel	16	NYS LEL	MG/KG	**29.8**	**J**	10.8	J	**30**	**J**	**23.7**	**J**	**30.6**	**J**
Potassium			MG/KG	1310	J	1250	J	2480	J	1450	J	2630	J
Selenium			MG/KG	0.8	U	1.1	U	0.84	U	1.3	U	1.4	U
Sodium			MG/KG	79.4		76.3	U	429		338		109	
Thallium			MG/KG	1.3		0.95	U	0.73	U	1.2	U	1.3	U
Vanadium			MG/KG	32.1		24.8		33		18.8		26.4	
Zinc	120	NYS LEL	MG/KG	78.4		57.6		85.5		**278**		**158**	

Note: Shaded values exceed NYS HHB, BALCT, LEL.

Table 4-47
SEAD-17 Summary of Analytes Detected in Sediment

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SW/SD17-5		SW/SD17-6		SW/SD17-7		SW/SD17-8		SW/SD17-9	
			SAMP ID:	16137A		16121A		16132A		16124A		16122A	
			QC CODE:	SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0	
			BOTTOM:	6		6		6		6		6	
			MATRIX:	SEDIMENT		SEDIMENT		SEDIMENT		SEDIMENT		SEDIMENT	
			SAMPLE DATE:	9/18/96		9/18/96		9/18/96		9/17/96		9/17/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
VOLATILE ORGANICS													
Acetone			UG/KG	20	U	26		13	U	10	J	14	U
Toluene			UG/KG	20	U	8	J	13	U	14	U	14	U
SEMIVOLATILE ORGANICS													
2,4-Dimethylphenol			UG/KG	570	U	560	U	500	U	500	U	460	U
2,4-Dinitrotoluene			UG/KG	570	U	560	U	500	U	450	J	460	U
Benzo(a)anthracene	15.99	NYS HHB	UG/KG	570	U	560	U	500	U	**25**	**J**	460	U
Benzo(a)pyrene	15.99	NYS HHB	UG/KG	570	U	560	U	500	U	**30**	**J**	460	U
Benzo(b)fluoranthene	15.99	NYS HHB	UG/KG	570	U	560	U	500	U	**43**	**J**	460	U
Benzo(g,h,i)perylene			UG/KG	570	U	560	U	500	U	31	J	460	U
Benzo(k)fluoranthene	15.99	NYS HHB	UG/KG	570	U	560	U	500	U	**33**	**J**	460	U
Chrysene	15.99	NYS HHB	UG/KG	570	U	560	U	500	U	**48**	**J**	460	U
Fluoranthene	12546	NSY BALCT	UG/KG	570	U	560	U	500	U	70	J	460	U
Indeno(1,2,3-cd)pyrene	15.99	NYS HHB	UG/KG	570	U	560	U	500	U	**24**	**J**	460	U
Phenanthrene	1476	NSY BALCT	UG/KG	570	U	560	U	500	U	35	J	460	U
Pyrene			UG/KG	570	U	560	U	500	U	47	J	460	U
bis(2-Ethylhexyl)phthalate	2460	NSY BALCT	UG/KG	570	U	560	U	500	U	77	J	460	U
PESTICIDES/PCB													
4,4'-DDD	0.123	NYS HHB	UG/KG	**3.2**	**J**	5.6	U	5	U	**13**	**J**	4.6	U

Note: Shaded values exceed NYS HHB, BALCT, LEL.

Table 4-47
SEAD-17 Summary of Analytes Detected in Sediment

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SW/SD17-5		SW/SD17-6		SW/SD17-7		SW/SD17-8		SW/SD17-9	
			SAMP ID:	16137A		16121A		16132A		16124A		16122A	
			QC CODE:	SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0	
			BOTTOM:	6		6		6		6		6	
			MATRIX:	SEDIMENT		SEDIMENT		SEDIMENT		SEDIMENT		SEDIMENT	
			SAMPLE DATE:	9/18/96		9/18/96		9/18/96		9/17/96		9/17/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
4,4'-DDE	0.123	NYS HHB	UG/KG	**13**		**6.5**		5	U	**62**	**J**	**2.9**	**J**
4,4'-DDT	0.123	NYS HHB	UG/KG	5.7	U	**3**	**J**	5	U	**12**	**J**	4.6	U
Dieldrin	1.23	NYS HHB	UG/KG	5.7	U	5.6	U	5	U	5	UJ	4.6	U
Endosulfan I	0.369	NSY BALCT	UG/KG	2.9	U	2.9	U	2.6	U	**1.6**	**J**	2.4	U
Endosulfan II	0.369	NSY BALCT	UG/KG	5.7	U	**3.7**	**J**	5	U	5	UJ	4.6	U
OTHER ANALYSES													
Nitrate/Nitrite-Nitrogen			MG/KG	0.02		0.1		0.06		0.09		0.04	
Percent Moisture (PEST/PCB)				42		41		34		34		29	
Percent Moisture (SVOCs)				42		41		34		34		29	
Percent Moisture (VOCs)				51		30		25		29		29	
Percent Solids (Metals)				58.2		58.7		66		65.8		70.9	
Total Organic Carbon			MG/KG	7900		36100		5910		17800		4090	
METALS													
Aluminum			MG/KG	14800		15900		15200		17100		22100	
Antimony	2	NYS LEL	MG/KG	0.88	UJ	1.2	UJ	0.85	UJ	**4.7**	**J**	0.73	UJ
Arsenic	6	NYS LEL	MG/KG	4.8		4.2		**6**		5		**7.5**	
Barium			MG/KG	103		73.2		124		157		92.4	
Beryllium			MG/KG	0.62		0.5		0.75		0.44		0.76	
Cadmium	0.6	NYS LEL	MG/KG	**2.1**		**1.1**		**0.68**		**2.7**		0.25	

Note: Shaded values exceed NYS HHB, BALCT, LEL.

Table 4-47
SEAD-17 Summary of Analytes Detected in Sediment

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

			LOC_ID:	SW/SD17-5		SW/SD17-6		SW/SD17-7		SW/SD17-8		SW/SD17-9	
			SAMP ID:	16137A		16121A		16132A		16124A		16122A	
			QC CODE:	SA		SA		SA		SA		SA	
			STUDY ID:	RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1		RI ROUND1	
			TOP:	0		0		0		0		0	
			BOTTOM:	6		6		6		6		6	
			MATRIX:	SEDIMENT		SEDIMENT		SEDIMENT		SEDIMENT		SEDIMENT	
			SAMPLE DATE:	9/18/96		9/18/96		9/18/96		9/17/96		9/17/96	
PARAMETER	LEVEL	SOURCE	UNIT	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
Calcium			MG/KG	3070		2780		4420		6150		2190	
Chromium	26	NYS LEL	MG/KG	19.8		23.8		22.3		23.3		**27.7**	
Cobalt			MG/KG	10		11		11		12		17.8	
Copper	16	NYS LEL	MG/KG	**46.6**	**J**	**36.4**	**J**	**26**	**J**	**309**	**J**	**34.1**	**J**
Iron	20000	NYS LEL	MG/KG	**24200**		**27800**		**27800**		**29400**		**35000**	
Lead	31	NYS LEL	MG/KG	**136**		**106**		**77.5**		**678**		**90.5**	
Magnesium			MG/KG	4210		5570		5080		4580		4830	
Manganese	460	NYS LEL	MG/KG	347		**488**	**J**	317	J	**768**	**J**	**565**	**J**
Mercury	0.15	NYS LEL	MG/KG	0.04	U	0.06	U	0.04	U	0.07		0.04	
Nickel	16	NYS LEL	MG/KG	**24.7**	**J**	**30.6**	**J**	**31.6**	**J**	**28.8**	**J**	**31.4**	**J**
Potassium			MG/KG	1660	J	1980	J	1810	J	2470	J	1950	J
Selenium			MG/KG	1.9		1.6	U	1.1	U	1.6		0.96	
Sodium			MG/KG	98.6		112	U	452		137		69	
Thallium			MG/KG	1		1.4	U	0.97	U	1.2	U	0.83	U
Vanadium			MG/KG	25		21.3		22.7		29.8		33.8	
Zinc	120	NYS LEL	MG/KG	96.6		97.6		98.6		**242**		108	

Note: Shaded values exceed NYS HHB, BALCT, LEL.

Table 4-48

VOCs and TICs in Sediment (ug/Kg)

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Sediment Sampling Location	Sediment Sample ID	Study ID	Total TCL VOCs	Total TICs	Total All VOCs
SW/SD17-1	16120A	Round I	15	0	15
SW/SD17-2	16130A	Round I	0	0	0
SW/SD17-3	16131A	Round I	0	0	0
SW/SD17-4	16136A	Round I	0	0	0
SW/SD17-5	16137A	Round I	0	0	0
SW/SD17-6	16121A	Round I	34	23	57
SW/SD17-7	16132A	Round I	0	0	0
SW/SD17-8	16124A	Round I	10	0	10
SW/SD17-9	16122A	Round I	0	0	0
SW/SD17-10	16123A	Round I	0	0	0

Table 4-49

SVOCs and TICs in Sediment (ug/Kg)

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Sediment Sampling Location	Sediment Sample ID	Study ID	Total TCL SVOCs	Total TICs	Total All SVOCs
SW/SD17-1	16120A	Round I	86	14000	14086
SW/SD17-2	16130A	Round I	0	16080	16080
SW/SD17-3	16131A	Round I	0	10990	10990
SW/SD17-4	16136A	Round I	36	20920	20956
SW/SD17-5	16137A	Round I	0	27840	27840
SW/SD17-6	16121A	Round I	0	13500	13500
SW/SD17-7	16132A	Round I	0	17050	17050
SW/SD17-8	16124A	Round I	913	18410	19323
SW/SD17-9	16122A	Round I	0	16590	16590
SW/SD17-10	16123A	Round I	62	14500	14562

4.2.5.5 Herbicides

Sediment samples collected from SEAD-17 was not analyzed for herbicides.

4.2.5.6 Metals

Metals were detected at all 10 sediment sampling locations at the site (Table 4-47). New York State lowest effect levels, as defined in Technical Guidance for Screening of Contaminated Sediments (NYSDEC, 1993) were used as a basis of comparison of metals concentrations in for the sediment samples.

Eleven metals (antimony, arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, and zinc) were found to exceed the NYS LEL criteria. The highest concentrations for several of the metals that exceeded their respective NYS LELs were detected at SW/SD17-3, which is located in the drainage ditch in the eastern portion of the site. Figure 4-15 shows the distribution of antimony, copper, lead, and zinc at the sediment sample locations.

The detection limits for all metals were below the respective NYS LEL values.

4.2.5.7 Other Constituents

Nitrate/Nitrite-Nitrogen

Nitrate/nitrite-nitrogen was measured in the ten sediment samples collected at SEAD-17. The concentrations ranged from 0.02 mg/kg to 0.24 mg/kg.

4.2.6 Summary of the Extent of Impacts at SEAD-17

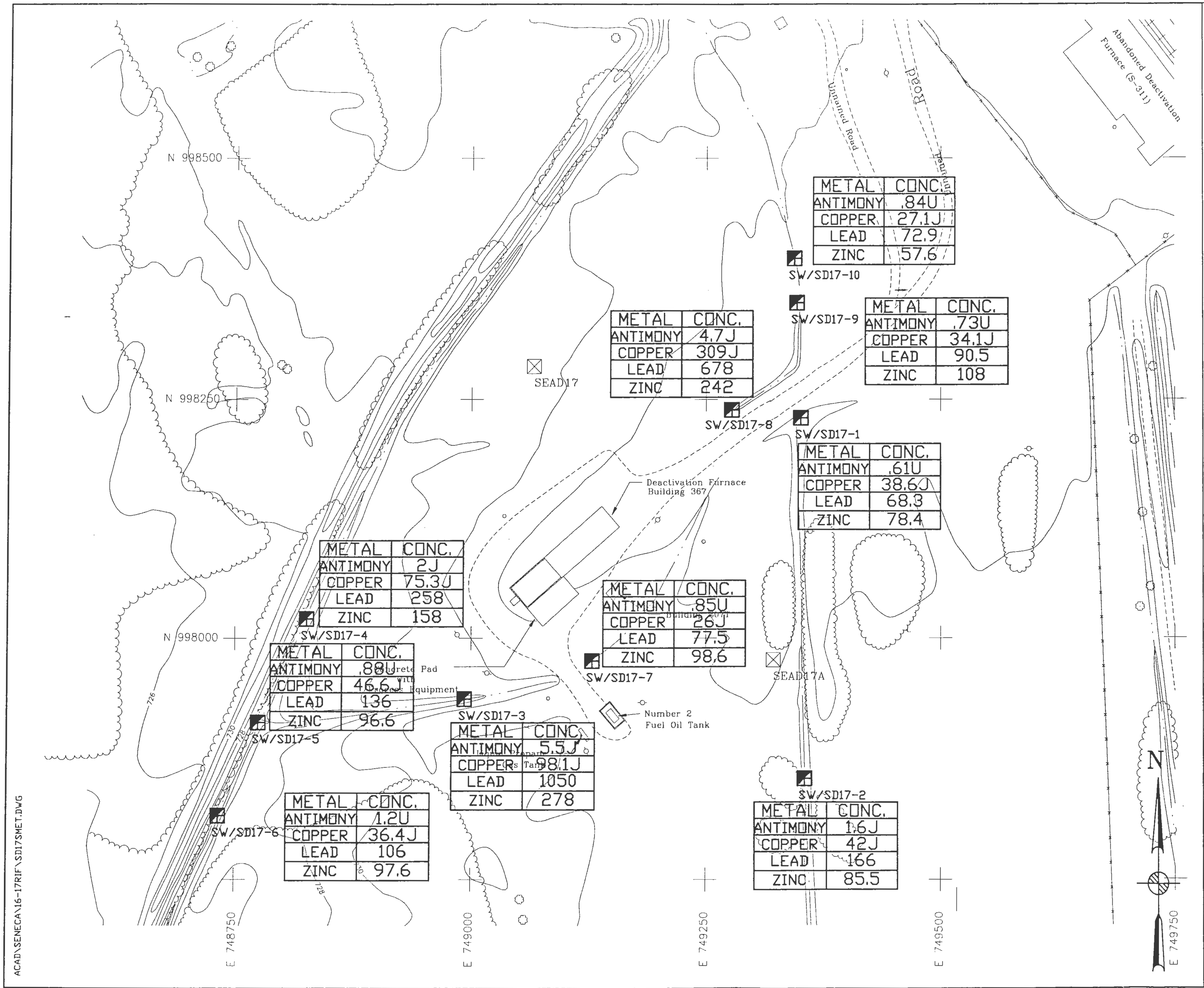
On the basis of the analytical results obtained for the five media at SEAD-17, the most significant impacts to the site are from metals. Impacts from SVOCs, pesticides, PCBs, herbicides, and nitroaromatics were also found.

In the soil at SEAD-17, metals were found to be pervasive in the surface and subsurface soils. Twenty-one metals were detected in the surface soils at concentrations above their respective TAGM values. Antimony, arsenic, copper, lead, mercury, and zinc were detected in almost all of the surface soil samples at concentrations above their respective TAGM values. In the subsurface soils, lead was detected in all samples at concentrations above the TAGM value. The metals were generally evenly distributed around Building 367 at SEAD-17, although some of the highest concentrations were located immediately to the southwest of the building. A potential source for some the high concentrations of metals in this area of the site is a discharge pipe, which has an outfall near location SS17-18, that drains the retort inside Building 367. Impacts from VOCs, SVOCs, pesticides, PCBs, herbicides, and nitroaromatics in soil were less significant than the impacts from metals

Generally, the groundwater at SEAD-17 has not been significantly impacted by any of the chemical constituents. Low concentrations of SVOCs were detected. Two metals did exceed their criteria values. Additionally, no VOCs, pesticides, PCBs, or nitroaromatics were detected in the groundwater.

Surface water impacts were not widespread and many of the chemical constituents analyzed for were not present in the samples. Most of the impacts from metals occurred in the surface water samples from the drainage ditch south of the Deactivation Furnace. No VOCs, pesticides, PCBs, or nitroaromatics were detected in the samples.

Sediment impacts were from SVOCs, pesticides, and metals. Impacts from SVOCs were most significant at SW/SD17-8 in the drainage ditch in the northeastern corner of the site. Pesticides were found in the drainage ditches in the western and northeastern portions of the site. Metals impacts were found at SW/SD17-3, which is located in the drainage ditch in the eastern portion of the site. No PCBs or nitroaromatics were detected.



SW/SD17-10

METAL	CONC.
ANTIMONY	.84U
COPPER	27.1J
LEAD	72.9
ZINC	57.6

SW/SD17-9

METAL	CONC.
ANTIMONY	.73U
COPPER	34.1J
LEAD	90.5
ZINC	108

SW/SD17-8

METAL	CONC.
ANTIMONY	4.7J
COPPER	309J
LEAD	678
ZINC	242

SW/SD17-1

METAL	CONC.
ANTIMONY	.61U
COPPER	38.6J
LEAD	68.3
ZINC	78.4

SW/SD17-4

METAL	CONC.
ANTIMONY	2J
COPPER	75.3J
LEAD	258
ZINC	158

SW/SD17-7

METAL	CONC.
ANTIMONY	.85U
COPPER	26J
LEAD	77.5
ZINC	98.6

SW/SD17-5

METAL	CONC.
ANTIMONY	.88J
COPPER	46.6J
LEAD	136
ZINC	96.6

SW/SD17-3

METAL	CONC.
ANTIMONY	5.5J
COPPER	98.1J
LEAD	1050
ZINC	278

SW/SD17-6

METAL	CONC.
ANTIMONY	1.2U
COPPER	36.4J
LEAD	106
ZINC	97.6

SW/SD17-2

METAL	CONC.
ANTIMONY	1.6J
COPPER	42J
LEAD	166
ZINC	85.5

SW/SD17-1

METAL	CONC.
ANTIMONY	.61U
COPPER	38.6J
LEAD	90.5
ZINC	108

CONCENTRATION IN mg/kg

PARSONS

PARSONS ENGINEERING SCIENCE, INC.

CLIENT/PROJECT TITLE
SENECA ARMY DEPOT ACTIVITY
RI/FS
SEAD-17 ACTIVE DEACTIVATION FURNACE

DEPT. ENVIRONMENTAL ENGINEERING
Dwg. No. 729895-01001

FIGURE 4-15
SEAD-17 METALS IN SEDIMENT SAMPLES

SCALE 1" = 100'
DATE DECEMBER 1996
REV A

ACAD\SENECA\16-17RIF\SD17SMET.DWG

5.0 CONTAMINANT FATE AND TRANSPORT

Chapter five presents site-specific conceptual site models, summarizes the chemical impacts present in various media at each site, and describes the potential transport of constituents of concern from each site. The chapter is organized into four sections, the first two address physical and chemical characteristics at SEAD-16 and SEAD-17, the third section deals with contaminant fate, and the fourth section with contaminant transport.

5.1 CONCEPTUAL SITE MODEL OF SEAD-16

The conceptual site model for SEAD-16 combines both site conditions and expected pollutant behavior into a cohesive understanding of the site. Taken together, the information collected during the groundwater, surface water, sediment, surface soil, and subsurface soil sampling, as well as survey data and field observations describe the physical characteristics of the site and chemical characteristics of the source areas at SEAD-16. Quantified, these characteristics become the framework for cursory partitioning and transport models that predict the behavior of inorganic constituents of concern at SEAD-16. The conceptual site model is the information described in the following subsections that defines the physical and chemical setting for subsequent modeling discussions.

5.1.1 Summary of Physical Site Characteristics

The Abandoned Deactivation Furnace building (Building S-311) and its associated Process Support Building (Building 366) are situated on approximately 2.6-acres of fenced land that comprise SEAD-16. The Abandoned Deactivation Furnace is located on a relatively flat part of the facility in the east-central portion of SEDA. The northeastern portion of the site is vegetated with low grass and the southwestern portion is paved with asphalt, which is cracked and badly deteriorated in some locations. There is little topographic relief on the site and no water bodies exist on-site. Surface water run-off is directed off-site to the southeast and southwest by small drainage swales.

The predominant surficial geologic unit present at the site is dense till. The till is distributed across the entire site and ranges in thickness from 0.5 feet to as much as 3.0 feet. In most locations a thin layer of fill covers the surface of the site. The fill becomes significantly thicker near the Abandoned Deactivation Furnace Building where it comprises the majority of the unconsolidated subsurface material. A zone of gray weathered shale of variable thickness is present below the till.

The thickness of the weathered shale ranges between 0.2 feet to 2.7 feet on the site. The average thickness on the site is 1.5 feet. Lastly, gray competent shale is present between 3.1 feet and 6.0 feet below the land surface.

Precipitation data from the nearest monitoring station (the Aurora Research Farm) was assessed to gain a perspective on the seasonal variations in precipitation that would directly impact surface water flow. This data indicates that, historically, June has the greatest amount of precipitation 3.9 inches, and the winter months (January and February) generally have the least amount of precipitation (Figure 1-14). Annual precipitation is approximately 30 inches. Surface water flow in drainage ditches on-site feeds into Kendaia Creek, which eventually empties into Seneca Lake approximately 4 miles west of the site. Overall site relief is low, and generally the land surface gradient at SEAD-16 is between 1 and 3 percent. Surface water flow from precipitation events is controlled by local topography, although there is little topographic relief on the site. There are no sustained surface water bodies on-site.

Till, including the weathered shale immediately below the till, and the underlying competent shale/limestone are the two distinct geologic units at SEAD-16 that store and transmit groundwater. The till and weathered shale behave as a single unconfined hydrological unit. However, it is noteworthy that at SEAD-16 there is no seasonally-sustained (and well-defined) direction of groundwater flow based on the groundwater topography maps presented in Section 3.0. The late summer water table conditions (i.e., August 1996) do not define a single direction of groundwater flow and the saturated thicknesses are small. Based on groundwater elevation data from other sites at SEDA (i.e., the Ash Landfill), the late summer and early fall are typically times when the saturated thickness of the till/weathered shale aquifer is the smallest for the year. It is apparent from the groundwater contours and saturated thicknesses of the till/weathered shale aquifer that seasonal precipitation events have an influence on groundwater flow direction. In the late summer and early fall the flow directions and gradients are likely to controlled more by bedrock topography than by a sustained regional gradient. And, when saturated thicknesses are greater in the winter and spring, groundwater flow directions shift in response to this increased thickness, especially in the northeastern portion of the site.

5.1.2 Summary of Chemical Impacts

On the basis of the analytical results obtained for the seven media (sediment, surface water, groundwater, surface soils, subsurface soils, solid samples from within the buildings and air samples) at SEAD-16, the most significant impacts to the site are from inorganics (i.e., metals). and to a lesser degree from SVOCs, pesticides, and nitroaromatics.

Metals and SVOCs, predominantly PAH compounds, were found to be pervasive, particularly in the surface and subsurface soils adjacent to the northeastern side of the Abandoned Deactivation Furnace building. Twenty one metals exceeded their respective TAGM screening values, however, some metals are considered to pose more of a threat than others. Among these latter metals lead, copper, arsenic, and zinc were detected in almost all of the surface soil samples at concentrations above their respective TAGM values. In the subsurface soils, lead and copper were found to be most widespread. The highest concentrations of carcinogenic PAH compounds in surface soils were detected in samples collected from locations adjacent to the northwestern corner of the Abandoned Deactivation Furnace Building. Nitroaromatic compounds were also present in the surface and subsurface soils near both buildings. Impacts from pesticides, PCBs, and herbicides in soil were less significant than the impacts from metals and SVOCs.

In the groundwater, seven metals were detected above the respective NYS Class GA or federal MCL standards. The metals were: lead, thallium, antimony, aluminum, iron, and sodium. Impacts from SVOCs and nitroaromatics were less significant. No VOCs, pesticides, or PCBs were detected in the groundwater at SEAD-16.

Generally, surface water impacts were from metals, which were found at concentrations that exceeded their standards at several locations. The metals included: lead, copper, zinc, cadmium, selenium, and iron. SVOCs were found in a few surface water samples, but only one was above the NYS Class C standard. Many of the other chemical constituents analyzed for were not present in the samples (i.e., no VOCs, pesticides, PCBs, or nitroaromatics were detected in the samples).

Sediment impacts were primarily from SVOCs and pesticides, which were pervasive. Several pesticide compounds exceeded their respective NYS sediment criteria and by far the most significant exceedences were in the sediment sample, SW/SD16-1, which was collected from the northeastern corner of the Abandoned Deactivation Furnace. Several metals were detected at concentrations above the NYS LEL with the highest concentrations found at SW/SD16-3 and SW/SD16-10. Impacts from nitroaromatics were less significant.

In the building material samples collected from the Abandoned Deactivation Furnace Building (S-311) and the Process Support Building (366), metals, SVOCs, and nitroaromatics were detected above TAGM values. The metals antimony, copper, lead, and zinc were detected in all the building material samples at concentrations above their respective TAGM values. However, impacts from VOCs, pesticides, PCBs, and herbicides were less significant. Asbestos was detected at 13 locations in the two buildings in such materials as pipe insulation, roofing material, and floor tiles.

On the basis of the chemical data collected at SEAD-16, the most predominant impacts are from inorganics (i.e., metals). Thus, the fate and transport sections that follow will focus on inorganics. However, the fate characteristics of some of the parameters with less significant impacts will also be discussed.

5.2 CONCEPTUAL SITE MODEL OF SEAD-17

The conceptual site model for SEAD-17 combines both site conditions and expected pollutant behavior into a cohesive understanding of the site. Taken together, information collected during the groundwater, surface water, sediment, surface soil, and subsurface soil sampling, as well as survey data and field observations, describe the physical characteristics of the site and chemical characteristics of the source areas at SEAD-17. Quantified, these characteristics become the framework for cursory partitioning and transport models that predict the behavior of inorganic constituents of concern at SEAD-17. The conceptual site model is the information described in the following subsections that defines the physical and chemical setting for subsequent modeling discussions.

5.2.1 Summary of Physical Site Characteristics

The Active Deactivation Furnace (SEAD-17) is located in the Ammunition Area in the east-central portion of SEDA approximately 800 feet southwest of SEAD-16. It is located approximately 500 feet west of the chain-link fence that defines the outer limits of the Ammunition Area at SEDA. SEAD-17 is characterized by an elongated deactivation furnace building that is surrounded by a crushed shale road (Figure 1-4). Beyond the crushed shale road is grassland. The site is generally flat around the furnace building, but the surrounding land slopes gently to the west and southwest Two small sheds are located in the eastern portion of the site.

As at SEAD-16, the predominant surficial geologic unit present at SEAD-17 is dense till. It ranges in thickness from 2.3 feet at MW17-4 to 6.0 feet at MW17-1 and had a average of 3.7 feet. A zone of gray weathered shale of variable thickness was encountered below the till at all of the locations drilled on-site. The thickness of the weathered shale is between 0.5 feet and 3.3 feet thick on site. Gray competent shale was encountered between 4.0 and 8.5 feet below the land surface in the borings performed on the site. The surface of the shale is uniformly sloped to the southwest, however, there is a local bedrock high in the vicinity of MW17-4. Generally, the slope of the bedrock beneath SEAD-17 corresponds with the regional slope of the surface of the bedrock, which is based on data from other nearby sites at SEDA.

The only filled areas noted on-site were in the immediate vicinity of the furnace building and near the aboveground fuel oil and propane tanks. Also, a thin mantle of fill (between 0.4 and 2 feet) was present in the northeastern and western portions of the site.

Precipitation data from the nearest monitoring station (Aurora Research Farm), was reviewed to gain a perspective on the seasonal variations in rainfall that would directly impact surface water flow. This data indicates that, historically, June has the greatest amount of precipitation, 3.9 inches, and the winter months (January and February) generally have had the least amount of precipitation (Figure 1-14). Annual precipitation is approximately 30 inches. Surface water flow from precipitation events is controlled by local topography. Most of the surface water in the immediate vicinity of the furnace building flows off of the crushed shale roadway surrounding it onto lower grassland. The regional overland surface water flow is believed to be controlled by the overall westward sloping ground surface. Much of the surface water flow is believed to be captured by drainage swales on the site, which make up a portion of the headwaters of Kendaia Creek. There are no sustained surface water bodies on-site and flow in the drainage ditches is believed to be ephemeral.

As at SEAD-16, the till/weathered shale, and the underlying competent shale/limestone are the two major geologic units at SEAD-17 that store and transmit groundwater. At SEAD-17 the direction of groundwater flow is to the southwest, and on the basis of the seasonally-collected groundwater data, this flow direction is sustained throughout the year. This data suggests that the groundwater gradient is also sustained throughout the year.

5.2.2 Summary of Chemical Impacts

On the basis of the analytical results obtained for the five media at SEAD-17, the most significant impacts to the site are from inorganics (i.e., metals). Impacts from SVOCs, pesticides, PCBs, herbicides, and nitroaromatics were also found.

In the soil at SEAD-17 , metals were found to be pervasive in the surface and subsurface soils. Impacts from VOCs, SVOCs, pesticides, PCBs, herbicides, and nitroaromatics in soil were less

significant than the impacts from metals. Twenty-one metals were detected in the surface soils at concentrations above their respective TAGM values. Antimony, arsenic, copper, lead, mercury, and zinc were detected in almost all of the surface soil samples at concentrations above their respective TAGM values. In the subsurface soils, lead was detected in all samples at concentrations above the TAGM value.

Generally, the groundwater at SEAD-17 has not been significantly impacted by any of the chemical constituents. Low concentrations of SVOCs were detected. Two metals did exceed their criteria values. Additionally, no VOCs, pesticides, PCBs, or nitroaromatics were detected in the groundwater.

Surface water impacts were not widespread and many of the chemical constituents analyzed for were not present in the samples. Most of the impacts from metals occurred in the surface water samples from the drainage ditch south of the Deactivation Furnace. No VOCs, pesticides, PCBs, or nitroaromatics were detected in the samples.

Sediment impacts were from SVOCs, pesticides, and metals. Impacts from SVOCs were most significant at one location in the drainage ditch in the northeastern corner of the site. Pesticides were found in the drainage ditches in the western and northeastern portions of the site. Metals impacts were found at SW/SD17-3, which is located in the drainage ditch in the eastern portion of the site. No PCBs or nitroaromatics were detected.

Similarly to SEAD-16, the chemical data collected at SEAD-16 indicates that the most predominant impacts are from inorganics (i.e., metals) and the fate and transport sections that follow will focus on inorganics. The fate characteristics of some of the parameters with less significant impacts will also be discussed.

5.3 CONTAMINANT FATE AT SEAD-16 AND SEAD-17

Contaminant fate refers to the chemical characteristics and predictable behaviors of a constituent of concern within different media at a site. This section presents a discussion of the fate characteristics of chemicals found at SEAD-16 and SEAD-17 and how the chemical-specific fate controls the distribution at the sites. Although the chemicals found at SEAD-16 and SEAD-17 were generally similar, this discussion will identify at which sites the chemicals were found. The complete analytical results for SEAD-16 and SEAD-17 are summarized in Chapter 4 and listed completely in Appendix G.

On the basis of the chemical impacts at both SEAD-16 and SEAD-17, the discussion of chemical fate will focus on inorganics (metals) in soil, however, the fate of organic chemicals found at the sites will also be discussed.

5.3.1 Overview of Compound Fate

5.3.1.1 Fate of Inorganics (metals)

This section is intended to provide background information that may be helpful when evaluating the fate of metals in soils at SEAD-16 and SEAD-17.

All soils naturally contain trace levels of metals. The concentration of metals in "uncontaminated" soils is primarily related to the geology of the parent material from which the soil was derived. Therefore, the concentrations of these metals can vary significantly depending on the composition of the parent bedrock material. Background concentrations for metals in till at SEDA have been established through an extensive sampling program that includes 57 samples of till (Table 5-1).

Water is generally responsible for the mobility of metals in soil systems. Metals associated with the aqueous phase of soil are subject to movement with soil water, and may be transported through the vadose zone to groundwater. However, the rate of migration of the metal usually does not equal the rate of water movement through the soil due to fixation and adsorption reactions (Dragun, 1988). While metals, unlike hazardous organics can not be degraded (McLean and Bledsoe, 1992) they may become immobile due to mechanisms of adsorption and precipitation.

Immobilization of metals, by mechanisms of adsorption and precipitation, will prevent movement of the metals to groundwater. Metals-soil interaction is such that when metals are introduced at the soil surface, downward transportation does not occur to any great extent unless the metal retention capacity of the soil is overloaded, or metal interaction with the associated waste matrix enhances mobility. Changes in soil environment conditions over time, such as the degradation of the organic waste matrix, changes in pH, redox potential, or soil solution composition, due to natural weathering processes, also may enhance the mobility of metals. The extent of vertical impacts is intimately related to the soil solution and surface chemistry of the soil matrix with reference to the metal and waste matrix in question.

In soils, metals are found in one or more of several categories in the soil. These categories as defined by Shuman (1991) are as follows:

1. dissolved in the soil solution;
2. occupying exchange sites on inorganic soil constituents;
3. specifically adsorbed on inorganic soil constituents;
4. associated with insoluble soil organic matter;
5. precipitated as pure or mixed solids;
6. present in the structure of secondary minerals; and/or
7. present in the structure of primary minerals.

In situations where metals have been introduced into the environment through human activities (as at SEAD-16 and SEAD-17), metals are associated with the first five categories. Native metals may be associated with the first five categories depending on the geological history of the area. The aqueous fraction, and those fractions in equilibrium with this fraction (i.e., the exchange fraction) are of primary importance when considering the migration potential of metals associated with soils.

The following paragraphs discuss general aspects of adsorption and leaching of metals in soil. In general, most soil possess a negative charge (Dragun, 1988), which is due to negative charges associated with clay surfaces. And, these negative charges on soil mineral surfaces are responsible for attracting cationic species of elements at soil surfaces.

However, humus, is also responsible for the accumulation of cationic species of elements at soil surfaces. Humus is the relatively stable fraction of soil organic matter that remains in soil after the chemicals comprising the plant and animal residues have decomposed (Dragun, 1988). Humus is colloidal in structure and the colloid surface possesses functional groups that posses negative charges. These charges are responsible for accumulating cationic species of elements at soil surfaces.

The process by which an ion in water, such as Cu^{2+}, is attracted to soil surface and displaces another cation is known as ion exchange. The term cation exchange specifically refers to the exchange between cations balancing the surface charge on the soil surface and the cations dissolved

TABLE 5-1
SENECA ARMY DEPOT
LIST OF SOIL BACKGROUND SAMPLES

Jan. 1998

LOC_ID:	SAMP ID:	QC CODE:	STUDY ID:	TOP:	BOTTOM:	MATRIX:	SAMPLE DATE:
B-8-91	S1105-24SOIL1	SA	RI PHASE1			SOIL	11/5/91
B-8-91	S1105-25SOIL1	SA	RI PHASE1			SOIL	11/5/91
B-8-91	S1105-26(1)SOIL1	SA	RI PHASE1			SOIL	11/5/91
B-8-91	S1105-27SOIL1	SA	RI PHASE1			SOIL	11/5/91
B-9-91	S1105-28SOIL1	SA	RI PHASE1			SOIL	11/5/91
B-9-91	S1105-29SOIL1	SA	RI PHASE1			SOIL	11/5/91
B-9-91	S1105-30RE(4)SOIL1	SA	RI PHASE1			SOIL	11/5/91
B-9-91	S1105-30SOIL1	SA	RI PHASE1			SOIL	11/5/91
BK-1	BK-1SOIL3	SA	RI PHASE1			SOIL	12/16/92
BK-2	BK-2RESOIL3	SA	RI PHASE1			SOIL	12/16/92
BK-2	BK-2SOIL3	SA	RI PHASE1			SOIL	12/16/92
GB35	GB35-1GRID	SA	RI PHASE1			SOIL	1/20/93
GB35	GB35-2GRID	SA	RI PHASE1			SOIL	1/20/93
GB35	GB35-6DUGRID	DU	RI PHASE1			SOIL	1/20/93
GB36	GB36-1GRID	SA	RI PHASE1			SOIL	1/20/93
GB36	GB36-2GRID	SA	RI PHASE1			SOIL	1/20/93
MW-34	S2011121MW34GRID	SA	RI PHASE1			SOIL	11/20/91
MW-34	S2011121MW34REGRID	SA	RI PHASE1			SOIL	11/20/91
MW25-1	SB25-6-01	SA	ESI	0	2	SOIL	12/3/93
MW25-1	SB25-6-02	SA	ESI	2	4	SOIL	12/3/93
MW25-6	SB25-7-00	SA	RI ROUND1	0	0.17	SOIL	9/25/95
MW25-6	SB25-7-03	SA	RI ROUND1	4	6	SOIL	9/25/95
MW25-6	SB25-7-04	SA	RI ROUND1	6	8	SOIL	9/25/95
MW25-6	SB25-7-10	DU	RI ROUND1	0	0.17	SOIL	9/25/95
MW64A-1	MW64A-1-1	SA	ESI	0	0.2	SOIL	4/2/94
MW64A-1	MW64A-1-2	SA	ESI	2	4	SOIL	4/2/94
MW64A-1	MW64A-1-3	SA	ESI	4	6	SOIL	4/2/94
MW64B-1	MW64B-1-1	SA	ESI	0	0.2	SOIL	5/13/94
MW64B-1	MW64B-1-2	SA	ESI	4	6	SOIL	5/13/94
MW64B-1	MW64B-1-3	SA	ESI	6	8	SOIL	5/13/94
MW67-2	MW67-2-00	SA	ESI	0	0.2	SOIL	3/30/94
MW67-2	MW67-2-02	SA	ESI	2	4	SOIL	3/30/94
MW67-2	MW67-2-03	SA	ESI	4	5	SOIL	3/30/94
MW70-1	MW70-1-00	SA	ESI	0	0.2	SOIL	5/11/94
MW70-1	MW70-1-02	SA	ESI	2	4	SOIL	5/11/94
MW70-1	MW70-1-03	SA	ESI	4	6	SOIL	5/11/94
SB11-3	SB11-3-1	SA	ESI	0	2	SOIL	11/2/93
SB11-3	SB11-3-2	SA	ESI	2	4	SOIL	11/2/93
SB11-3	SB11-3-6	SA	ESI	10	12	SOIL	11/3/93
SB13-1	SB13-1-1	SA	ESI	0	2	SOIL	12/8/93
SB13-1	SB13-1-2	SA	ESI			SOIL	
SB13-1	SB13-1-3	SA	ESI	6	8	SOIL	12/8/93
SB13-1	SB13-1-4	SA	ESI	8	10	SOIL	12/8/93
SB13-6	SB13-6-1	SA	ESI	0	2	SOIL	12/15/93
SB13-6	SB13-6-3	SA	ESI	4	6	SOIL	12/15/93
SB13-6	SB13-6-4	SA	ESI	6	8	SOIL	12/15/93
SB17-1	SB17-1-1	SA	ESI	0	2	SOIL	12/1/93
SB17-1	SB17-1-2	SA	ESI	2	4	SOIL	12/1/93

TABLE 5-1
SENECA ARMY DEPOT
LIST OF SOIL BACKGROUND SAMPLES

LOC_ID:	SAMP ID:	QC CODE:	STUDY ID:	TOP:	BOTTOM:	MATRIX:	SAMPLE DATE:
SB17-1	SB17-1-3	SA	ESI	4	6	SOIL	12/1/93
SB24-5	SB24-5-1	SA	ESI			SOIL	
SB24-5	SB24-5-3	SA	ESI			SOIL	
SB24-5	SB24-5-5	SA	ESI			SOIL	
SB26-1	SB26-1-1	SA	ESI	0	2	SOIL	11/17/93
SB26-1	SB26-1-2	SA	ESI	2	4	SOIL	11/17/93
SB4-1	SB4-1-1	SA	ESI	0	2	SOIL	12/6/93
SB4-1	SB4-1-10	DU	ESI	0	2	SOIL	12/6/93
SB4-1	SB4-1-2	SA	ESI	4	6	SOIL	12/6/93
SB4-1	SB4-1-3	SA	ESI	8	10	SOIL	12/6/93
SS16-16	SS16-16-1	SA	ESI	0	0.2	SOIL	10/20/93
TP57-11	TP57-11-1	SA	ESI	3	3	SOIL	11/8/93

in water (Dragun, 1988). The total amount of cations adsorbed by these negative charges on a unit mass of soil is defined as the cation exchange capacity of the soil (CEC), which is a stoichiometric and reversible process (Dragun, 1988).

The process by which a cation combines with molecules or anions containing free pairs of electrons is known as complex formation (Dragun, 1988). The cation-anion or cation-molecule combination is known as a complex. The anion(s) or molecule(s) with which the cation forms a complex is usually referred to as a ligand.

According to Dragun (1988), the equilibrium distribution of a cation is governed by two opposing rate processes, the adsorption rate and the desorption rate. The adsorption rate is the rate at which the dissolved cation in water transfers into the adsorbed state. The desorption rate is the opposite process; it is the rate at which the cation transfers from the adsorbed state into water. The extent of adsorption is expressed using the adsorption coefficient or distribution coefficient, K_d. The distribution coefficient is defined as the ratio of the concentration of a solute adsorbed on soil surfaces to the concentration of the solute in water. The greater the extent of adsorption, the greater the magnitude of K_d. K_d values are different among the various metals, and K_ds measured for an individual metal in soil can vary. The distribution coefficients for the inorganics of concern at SEAD-16 and SEAD-17 are discussed in detail in the transport section of the RI (Section 5.4.4).

Another property of soil that is often correlated with potential migration of metals is soil pH (McLean and Bledsoe, 1992). At soil pH of greater than 6.5, most metals, especially those normally present as cations, are fairly immobile. At higher pH values, metals can form insoluble carbonate and hydroxide complexes. Metals would be most mobile in highly acidic soils, e.g., those with a pH of 5 or less. The chemistry of all cationic metals in soil is also controlled by pH. While direct measurements of soil pH are not available for SEAD-16 and SEAD-17, the pH of groundwater from the seven wells samples during Round 1 was 7.5. And, by association the pH of the soil is approximately 7.5, as one would not expect its pH to be considerably different than the pH of the groundwater. Additionally, Hutton (1972), indicates that Darian (DaA) soils like those found at SEAD-16 and SEAD-17 have pH values that vary depending on the depth of the soil. The pH values are as follows:

1. pH of 5.1 to 7.0 from 0 to 10 inches below the ground surface;
2. pH of 6.1 to 7.5 from 10 to 24 inches below the ground surface;
3. pH of 7.0 to 8.4 from 24 to 50 inches below the ground surface (calcareous soil).

These data provide support for our contention that the pH value for groundwater of 7.5 approximately reflects that pH of the soil found at SEAD-16 and SEAD-17. This pH value is considered to be neutral.

Dragun (1988) reveals several general trends regarding element mobility using the results of studies of 10 soils in the published literature. They are as follows:

1. Cations and anions exhibit low mobility in clay and silty clay soils. As the surface areas and the clay content increases, the ability of the soil to retain cations and anions will generally increase. [Thus, the high silt and clay content of the soils at SEAD-16 and SEAD-17 would tend to reduce the mobility of cations in soil.]
2. Cations usually exhibit moderate to high mobility in sandy, loamy sand, and sandy loam soil.
3. Cations can exhibit low, moderate, or high mobility in soils with intermediate textures. and
4. Anions usually exhibit relatively low mobility in clay and silty clay soils and moderate to high mobility in other soil types. [Thus, the high silt and clay content of the soils at SEAD-16 and SEAD-17 would tend to reduce the mobility of anions in soil.]

As mentioned above, the leaching of metals from soils is controlled by numerous factors. An important consideration for leach of metals is the chemical form (base metal or cation) present in the soil. However, at SEAD-16 and SEAD-17, the exact form (or speciation) of the individual inorganics is not known. We suspect that many of the metals are expected to be associated with oxides due to the nature of the activities at the deactivation furnaces. These activities included deactivating (through incineration) small arms ammunition, which consisted predominantly of metal casings and propellant.

The leaching of metals from soils is substantial if the metal exists as a soluble salt. Metallic salts have been identified as a component of such items as tracer ammunition, ignitor compositions, incendiary ammunition, flares, colored smoke and primer explosive compositions. For example, barium nitrate, lead stearate, lead carbonate, and mercury fulminate are likely metal salts or complexes that may have been incinerated at the sites. During the burning of these materials, a portion of these salts were likely oxidized to their metallic oxide forms. In general, metallic oxides are considered to be less likely to leach metallic ions than metallic salts.

The discussion of the individual metals below, is meant to provide an overview of the characteristics that affect the fate of each of the metals, and is not restricted to discussion of metal oxides only. Much of the information below was obtained from McLean and Bledsoe (1992).

Arsenic

In the soil environment arsenic exists as either arsenate, As (V), or arsenite, As(III), however, arsenite is the more toxic form. And, arsenite compounds are reported to be 4 to 10 times more soluble than arsenate compounds (McLean and Bledsoe, 1992).

The adsorption of both forms of arsenic is strongly pH dependent. Griffin and Shimp (1978) found that arsenate had a maximum adsorption in soils with a pH of 5. These same researchers found that arsenite sorption was observed to increase over a pH range of 3 to 9. Other researches found the maximum adsorption of As(III) by iron oxide occurred at pH of 7.

Both pH and redox are important in assessing the fate of arsenic in soil. At high redox levels, As(V) predominates and arsenic mobility is low and as the pH increases or the redox decreases As(III) predominates (McLean and Bledsoe, 1992). The reduced form of arsenic is more subject to leaching because of its high solubility. Also, arsenite, As(III), can be oxidized to As(V) and manganese oxides are the primary electron acceptor in this oxidation (Oscarson et al., 1983).

Barium

Barium is a highly reactive metals that occurs naturally only in the combined state. Most barium is released into the environment form industrial sources in forms that do not become widely dispersed. In the atmosphere, barium is likely to be present in particulate form. Environmental fate processes may transform one barium compound to another; however, barium itself is not degraded. It is removed from the atmosphere primarily by wet or dry deposition.

Barium in soil may be taken up to a small extent either by vegetation, or transported through soil with precipitation. Barium is not very mobile in most soil systems. The higher the level of organic matter in the soil, the greater the adsorption. The presence of calcium carbonate will also limit mobility, since barium will form barium carbonate ($BaCO_3$), an insoluble carbonate.

Cadmium

Cadmium may be adsorbed by clay minerals, carbonates, or hydrous oxides or iron and manganese or may be precipitated as calcium carbonate, hydroxide, and phosphate. Evidence suggests that adsorption mechanisms may be the primary source of cadmium removal from soils. Several authors have reported that in soils polluted with metals wastes, the greatest percentage of the total cadmium was associated with the exchangeable fraction (McLean and Bledsoe, 1992). As with all cationic metals, the chemistry of cadmium in the soil environment is to a greater extent controlled by pH. Under acidic conditions cadmium solubility increases and very little adsorption of cadmium by soil colloids, hydrous oxides, and organic matter takes place. At pH values greater than 6, cadmium is adsorbed by the soil solid phase or is precipitated, and the solution concentrations of cadmium are greatly reduced. Cadmium forms soluble complexes with inorganic and organic ligands. The formation of these ligands will increase the mobility of cadmium in soils.

Chromium

Chromium exists in two possible oxidation states in soils, trivalent chromium, Cr(III), and hexavalent chromium Cr(VI). Hexavalent chromium is the more toxic of the two forms.

Forms of Cr(VI) in soils predominate at pH values of less than 6.5. Because of the anionic structure of Cr(VI), its association with soil surfaces is limited to positively charged exchanges sites, the number of which decreases with increasing soil pH (McLean and Bledsoe, 1992). Generally, hexavalent chromium is highly mobile in soils. However, some researches have found that clay soil, containing free iron and manganese oxides, significantly retarded Cr(VI) migration. Cr(VI) was also found to be highly immobile in alkaline soils.

Trivalent chromium is readily adsorbed by soils. Hexavalent chromium can be reduced to Cr(III) under normal soil pH and redox conditions and soil organic matter has been identified as the electron donor in this reaction (Bartlett and Kimble, 1976; Bloomfield and Pruden, 1980). Barlett and James (1979) showed that Cr(III) could be oxidized under conditions prevalent in some soils.

Copper

Copper is dispersed through the atmosphere primarily as a result of anthropogenic activities. Environmental fate processes may transform one form of copper to another; however, copper itself is not degraded. Most of the copper in the atmosphere occurs in the aerosol form, and long-distance transport may occur. Wet or dry deposition is expected to be the primary fate process in air.

The degree of persistence of copper in soil depends on the soil characteristics and the forms of the copper that are present. Copper is retained in soils through exchange and specific adsorption mechanisms (McLean an Bledsoe, 1992). At concentrations found in native soils, copper precipitates are unstable. This may not be the case in waste-soil systems and precipitation may be an important mechanism of retention. McLean and Bledsoe (1992) state that copper is adsorbed to a greater extent by soils and soil constituents than other metals studied (arsenic, cadmium, nickel, zinc, mercury, silver, and selenium), with the exception of lead. They note, however, that copper has a high affinity for soluble organic ligands and the formation of these complexes may greatly enhance copper mobility in soil. Copper is not expected to volatilize from soil.

Lead

Lead is extremely persistent in both soil and water. Environmental fate processes that transform one lead compound to another, however, the lead is generally present in the +2 oxidation state, and will form lead oxides, although the lead itself is not degraded.

Soluble lead added to the soil reacts with clays, phosphates, sulfates, carbonates, hydroxides, and organic matter such that lead solubility is greatly reduced. At pH values above 6, lead is either adsorbed on clay surfaces or forms lead carbonate. Generally, studies that evaluate the relative affinity of metals for soils and soil constituents, lead is sorbed by soils and soil constituents to the greatest extent compared to Cu, Zn, Cd, and Ni (McLean and Bledsoe, 1992). Some authors have demonstrated decreased sorption of lead in the presence of complexing ligands and complexing cations. Lead has a strong affinity for organic ligands and the formation of such complexes may greatly increase the mobility of lead in soil.

Mercury

The distribution of mercury species in soils (elemental mercury, mercurous ions, and mercuric ions) is dependent on soil pH and redox potential (McLean and Bledsoe, 1992). Both the mercurous and mercuric cations are adsorbed by clay minerals, oxides, and organic matter. Adsorption is pH dependent, increasing with increasing pH. Mercurous and mercuric mercury are also immobilized by forming various precipitous, Mercurous mercury precipitates with chloride, phosphate, carbonate, and hydroxide. At concentrations of mercury commonly found in soil, only the phosphate precipitate is stable. In alkaline soils, mercuric mercury will precipitate with carbonate and hydroxide to form a stable solid phase. At lower pH and high chloride concentrations, HgCl2 is formed. Divalent mercury also will form complexes with soluble organic matter, chlorides, and hydroxides that may contribute to its mobility (Kinniburgh and Jackson, 1978).

Under mildly reducing conditions, both organically bound mercury and inorganic mercury compounds may be degraded to the elemental form of mercury, Hg0. Elemental mercury can readily be converted to methyl or ethyl mercury by biotic and abiotic processes (Roger, 1976, 1977). These are the most toxic forms of mercury. Some researchers have estimated that mercury can be removed due to volatilization and/or precipitation and the removal increased with pH. The volatilization was found to be inversely related to soil adsorption capacity.

Nickel

Nickel does not form insoluble precipitates in unpolluted soils and retention of nickel is, therefore, exclusively through adsorption mechanisms (McLean and Bledsoe, 1992). Nickel will adsorb to clays, iron, and manganese oxides, and organic matter and it thus removed from the soil solution. The formation of complexes nickel with both inorganic and organic ligands will increase nickel mobility in soils.

Silver

Published data concerning the interaction of silver with soil are rare. As a cation it will participate in adsorption and precipitation reactions. Silver is very strongly adsorbed by clay and organic matter and precipitates of silver, AgCl, Ag_2SO4, and $AgCO_2$, are highly insoluble Lindsay, 1979). Silver is highly immobile in the environment.

Zinc

Zinc is stable in dry air, but upon exposure to moist air it will form a white coating composed of basic carbonate. Zinc loses electrons (oxidizes) in aqueous environments. In the environment zinc is found primarily in the +2 oxidation state. Elemental zinc is insoluble and most zinc compounds show negligible solubility as well, with the exception of elements (other than fluoride) from Group VIIa of the Periodic Table compounded with zinc (i.e., $ZnCl_2$, and ZnI_2) that show a general 4:1 compound to water solubility level. In contaminated waters, zinc often complexes with a variety of organic and inorganic ligands. Therefore, the overall mobility of zinc in an aqueous environment, or through moist to wet soils, may be accelerated by compounding/complexing reactions.

Zinc is readily adsorbed to clay minerals, carbonates, or hydrous oxides. Several authors noted in McLean and Bledsoe (1992) found that the greatest percent of the total zinc found in "polluted" soils and sediments was associated with iron and magnesium oxides. Precipitation of zinc is not a major mechanism of retention of zinc in soils because of the relatively high solubility of zinc compounds. Precipitation may be a more significant mechanism of zinc retention in soil-waste systems. Zinc adsorption increases with pH, and hydrolized species are strongly adsorbed to soil surfaces. McLean and Bledsoe (1992) also state that zinc forms complexes with inorganic and organic ligands that will affect its adsorption reactions with the soil surface. Volatilization of zinc is not an important process from soil or water.

5.3.1.2 Fate of Organics

On the basis of the chemical data at SEAD-16 and SEAD-17, the organics that will be addressed in this section include the following: semivolatile organic compounds, pesticides/PCBs, herbicides, and nitroaromatics. However, as noted in the previous sections, impacts from these chemicals are not believed to be as significant as those for inorganics.

Organic compounds are affected by both external site conditions and the compounds' inherent chemical and physical properties. These properties will, in combination, determine the compound state and provide insight into its mobility within a media. In the following discussion, the fate characteristics of semivolatile organic compound, pesticides/PCBs, herbicides, and explosives are discussed.

Semivolatile Organic Compounds

Semivolatile organics are characterized by low vapor pressures and low Henry's Law constants, indicating little potential for volatilization (Table 5-2). High sorption coefficients (7,500 ml/g) indicate that these chemicals will tend to stay sorbed to the soil, and will migrate only in conjunction with the soil itself.

PAH compounds have a high affinity for organic matter and low water solubility. Most PAHs have organic carbon partition coefficient (K_{OC}) values greater than 2,000 ml/g, indicating that they are immobile (Table 5-3). [K_{OC} is the ratio of the amount of the compound present in the organic fraction to that present in the aqueous fraction, at equilibrium]. Water solubility tends to decrease and affinity for organic material tends to increase with increasing molecular weight (Gas Research Institute, 1988). Therefore, naphthalene is much more soluble in water than is benzo(a)pyrene. When present in soil or sediments, PAHs tend to remain bound to the soil particles and dissolve only slowly into groundwater or the overlying water column. Because of the high affinity for organic matter, the physical fate of the chemicals is usually controlled by the transport of particulates. Thus, soil, sediment and suspended particulate matter (in air) represent important media for the transport of the chemicals.

Because of their high affinity for organic matter, PAH compounds are readily taken up (bioaccumulated) by living organisms. However, organisms have the potential to metabolize the chemicals and to excrete the polar metabolites (Gas Research Institute, 1988). The ability to do this varies among organisms. Fish appear to have well-developed systems for metabolizing the chemicals. The metabolites are excreted. Shellfish (bi-valves) appear to be less able to metabolize the compounds (Gas Research Institute, 1988). As a result, while PAH compounds are seldom high in fish tissues, they can be high in shellfish tissues.

Several factors can degrade PAH compounds in the environment. Biodegradation on soil microorganisms is an important process affecting the concentrations of the chemicals in soils, sediment and water. Volatilization may also occur. This mechanism is effective for the lighter molecular weight compounds. However, the volatilization of higher molecular weight PAH compounds occurs slowly.

Phenolic compounds, classified as SVOCs, generally have lower Koc values than PAHs (< 300 ml/g) are highly water soluble and, therefore, easily leach from soil environments into the underlying groundwater. They are not persistent in surface water environments. Phenolics are

Table 5-2

Summary of Fate and Transport Parameters for Selected Organic Compounds of Concern

SEAD-16 and SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Compound	Solubility (mg/l)	Vapor Pressure (mmHg)	Henry's Law Constant (atm-m^3/mol)	Organic Carbon Partition Coefficient, Koc (ml/g)	Octanol-Water Partition Coefficient, Kow	Half-Life (days)	Bioconcentration Factor (BCF)
Semivolatile Organic Compounds							
Phenol	93000	0.341	4.54E-07	14.2	28.8	3-5	1.4-2
1,4-dichlorobenzene	79	1.18	2.89E-03	1,700	3,980		60-117
2-Methylphenol	25000	0.24	1.50E-06	274	89.1	1-3	
4-Methylphenol		0.11	4.43E-07	267	85.1	1-3	
2,4-Dimethylphenol	4200	0.0573	2.38E-06	222	263	1-3	9.5-150
Benzoic Acid	2700			248	74.1		
Naphthalene	31.7	0.23	1.15E-03	1,300	2,760	1-110	44-95
2-Methylnaphthalene	25.4	0.0083	5.80E-05	8,500	13,000	1-3	
2-Chloronaphthalene	6.74	0.017	4.27E-04	4,160	13,200		
2,6-Dinitrotoluene	1320	0.018	3.27E-06	92	100	4	4.6
4-Chloroaniline	3900	0.025	1.07E-05				
Acenaphthylene	3.93	0.029	1.48E-03	2,500	5,010		
Acenaphthene	3.42	0.00155	9.20E-05	4,600	10,000		
Dibenzofuran				4,160	13,200		
2,4-Dinitrotoluene	240	0.0051	5.09E-06	45	100	5	
Diethylphthalate	896	0.0035	1.14E-06	142	316	1-3	14-117
Carbazole							
Fluorene	1.69	0.00071	6.42E-05	7,300	15,800	32-60	
N-Nitrosodiphenylamine	113		1.40E-06	650	1,350	4	65-217
N-Nitroso-di-n-propylamine							
Hexachlorobenzene	0.006	0.000019	6.81E-04	3,900	170,000		
Pentachlorophenol	14	0.00011	2.75E-06	53,000	100,000		13-6300
Phenanthrene	1	0.00021	1.59E-04	14,000	28,800	1-200	
Anthracene	0.045	0.000195	1.02E-03	14,000	28,200	200-460	
Di-n-butylphthalate	13	0.00001	2.82E-07	170,000	398,000	1-3	89-1800
Fluoranthene	0.206	0.0177	6.46E-06	38,000	79,400	140-440	
Pyrene	0.132	2.50E-06	5.04E-06	38,000	75,900	9-1900	
Butylbenzylphthalate	2.9	8.60E-06	1.20E-06	28,400	58,900		663
Benzo(a)anthracene	0.0057	1.50E-07	1.16E-06	1,380,000	398,000	240-680	
Chrysene	0.0018	6.30E-09	1.05E-06	200,000	407,000	160-1900	

Table 5-2

Summary of Fate and Transport Parameters for Selected Organic Compounds of Concern

SEAD-16 and SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Compound	Solubility (mg/l)	Vapor Pressure (mmHg)	Henry's Law Constant (atm-m^3/mol)	Organic Carbon Partition Coefficient, Koc (ml/g)	Octanol-Water Partition Coefficient, Kow	Half-Life (days)	Bioconcentration Factor (BCF)
Bis(2-Ethylhexyl)phthalate	0.285	2.00E-07	3.61E-07	5,900	9,500	Neg. Deg.	
Di-ni-octylphthalate	3			2,400,000	1,580,000,000		
Benzo(b)fluoranthene	0.014	5.00E-07	1.19E-05	550,000	1,150,000	360-610	
Benzo(k)fluoranthene	0.0043	5.10E-07	3.94E-05	550,000	1,150,000	910-1400	
Benzo(a)pyrene	0.0012	0.000568	1.55E-06	5,500,000	1,150,000	220-530	
Indeno(1,2,3-cd)pyrene	0.00053	1.00E-10	6.86E-08	1,600,000	3,160,000	600-730	
Dibenz(a,h)anthracene	0.0005	5.20E-11	7.33E-08	3,300,000	6,310,000	750-940	
Benzo(g,h,i)perylene	0.0007	1.03E-10	5.34E-08	1,600,000	3,240,000	590-650	
Pesticides/PCBs							
beta-BHC	0.24	2.80E-07	4.47E-07	3,800	7,940	Neg. Deg.	
gamma-BHC (Lindane)	7.8	0.00016	7.85E-06	1,080	7,940	Neg. Deg.	250
gamma-Chlordane							
Heptachlor	0.18	0.0003	8.19E-04	0.00012	25,100	Neg. Deg.	3600-37000
Aldrin	0.18	6.00E-06	1.60E-05	96,000	200,000	Neg. Deg.	3890-12260
Endosulfan I	0.16	0.00001	3.35E-05	2,030	3,550		
Heptachlor epoxide	0.35	0.0003	4.39E-04	220	501	Neg. Deg.	851-66000
Dieldrin	0.195	1.78E-07	4.58E-07	1,700	3,160	Neg. Deg.	3-10000
4,4'-DDE	0.04	6.50E-06	6.80E-05	4,400,000	10,000,000	Neg. Deg.	110000
Endrin	0.024	2.00E-07	4.17E-06	19,100	218,000	Neg. Deg.	1335-49000
Endosulfan II	0.07	0.00001	7.65E-05	2,220	4,170		
4,4'-DDD	0.16	2.00E-09	3.10E-05	240,000	360,000	Neg. Deg.	
Endosulfan sulfate	0.16			2,330	4,570		
4,4'-DDT	0.005	5.50E-06	5.13E-04	243,000	1,550,000	Neg. Deg.	38642-110000
Endrin aldehyde							
Endrin ketone							
alpha-Chlordane	0.56	0.00001	9.63E-06	140,000	2,090	Neg. Deg.	400-38000
Aroclor-1254	0.012	0.00008	2.70E-03	42,500	1,070,000	42	10E4-10E6
Aroclor-1260	0.0027	0.000041	7.10E-03	1,300,000	13,800,000	Neg. Deg.	10E4-10E6
Herbicides							
MCPA							
MCPP							

Table 5-2

Summary of Fate and Transport Parameters for Selected Organic Compounds of Concern

SEAD-16 and SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Compound	Solubility (mg/l)	Vapor Pressure (mmHg)	Henry's Law Constant (atm-m³/mol)	Organic Carbon Partition Coefficient, Koc (ml/g)	Octanol-Water Partition Coefficient, Kow	Half-Life (days)	Bioconcentration Factor (BCF)
2.4.5-T	278	7.5E-07	8.68E-09	650			65
Nitroaromatics							
1.3-Dinitrobenzene	470			150	41.7		
Tetryl							
2-amino-4.6-Dinitrotoluene							
2.6-Dinitrotoluene	182	0.018	3.27E-06	249	100	4	4.6
2.4-Dinitrotoluene	270	0.0051	5.09E-06	201	100	5	

References:
1. IRP Toxicology Guide
2. Basics of Pump-and-Treat Ground-Water Remediation Technology (EPA, 1990).
3. Handbook of Environmental Fate and Exposure Data (Howard, 1989).
4. Soil Chemistry of Hazardous Materials (Dragun, 1988)
5. Hazardous Waste Treatment, Storage, and Disposal Facilities, Air Emissions Models (EPA, 1989).
6. USATHAMA, 1985
7. Values for Koc not found were estimated by: logKoc = 0.544logKow + 1.377 (Dragun, 1988).

Table 5-3

Relative Relationship Between Koc and Mobility of Organic Chemicals

SEAD-16 and SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Koc	Class	Mobility
>2,000	I	Immobile
500-2,000	II	Low Mobility
150-500	III	Intermediate Mobility
50-150	IV	Mobile
<50	V	Very Mobile

Notes:
1) Koc = Organic carbon partition coefficient
2) Source: Dragun, 1988.

not as volatile as benzene, xylene or toluene, but can volatilize at a moderate rate. Therefore, there may be some potential for exposure to gases. Non-chlorinated phenolic compounds are not readily bioaccumulated by terrestrial or aquatic biota (Gas Research Institute, 1988).

Pesticides/PCBs

The pesticide compounds 4,4-DDT, 4,4-DDE, and 4,4-DDD are all expected to be highly immobile in the soil/groundwater environment when present at low dissolved concentrations (Installation Restoration Program Toxicity Guide, 1987). Bulk quantities of these compounds dissolved in an organic solvent could be transported through the unsaturated zone as the result of a spill. However, their extremely low solubility and their strong tendency to sorb to soils results in a very slow transport rate in soils.

The fate of Aroclor® mixtures (including 1254 and 1260, which were found at SEDA) is a direct function of their relative composition with respect to the individual chlorinated biphenyl species. These individual species in a pure state are generally solids at room temperature, but Aroclor® mixtures are oily at room temperature. Based on equilibrium partitioning modeling cited in the Installation Restoration Program Toxicity Guide (1987), almost all of the Aroclor® mixtures are expected to be associated with the stationary (or soil) phase. Much less than 1 percent is expected to partition to the soil-water phase, and only a small amount would be available to migrate via the downward movement of infiltrating water. Generally, groundwater beneath soils that contain PCBs is not expected to be adversely impacted.

Herbicides

The herbicide 2,4,5-T is expected to be relatively mobile in the soil/groundwater system when present at low dissolved concentrations. Bulk quantities of this solution could be transported rapidly through the unsaturated zone. However, 2,4,5-T has been shown to be highly susceptible to degradation in the soil/groundwater system and is not expected to be persistent.

Nitroaromatics

Table 5-2 presents the information that will serve as a basis for understanding the likely environmental fate of nitroaromatics found at the deactivation furnaces. The chemical class of the compounds identified in Table 5-2 is considered to be semivolatile. This is based upon the high molecular weights of these compounds and their low vapor pressures, typical of most semivolatile compounds. The most volatile of the five explosives considered at this site is 2,6-dinitrotoluene (2,6 DNT), with a vapor pressure of 0.018 millimeters mercury (mm Hg). Compared to benzene, a volatile compound, which has a vapor pressure of 95.2 mm Hg it is apparent that volatilization of this compound is expected to be low, especially in soils which have a high clay content. Soils with a high clay content generally have a high, i.e. >50%, ratio of water filled to air filled porosity, therefore, there is a small amount of air space through which vapor can migrate.

The potential for explosives to leach to the groundwater is a complicated consideration and influenced by many factors such as solubility, cation exchange capacity (CEC), clay content and percolation rate. For this evaluation, solubility has been considered as the most representative parameter for leaching potential. Of the five explosives considered, the most soluble of the explosives are the di- and trinitrotoluenes. Their solubilities range from approximately 130 mg/l to 270 mg/l. These are similar to the solubilities of organic hydrocarbons such as toluene, (500 mg/l), or the xylenes, (150 mg/l). This range of solubilities is considered to represent a moderate degree of leaching potential. Compounds which would represent a high degree of leachibility, i.e., high solubility, would be methylene chloride, (20,000 mg/l), benzene (1,780 mg/l) and TCE, (1100 mg/l).

A review of the melting points of these compounds indicates that explosives are solids at room temperature and therefore would not migrate through soil as separate liquid phases. Instead, as precipitation interacts with these solid residues a small portion would dissolve or erode away. Complete leaching would require a long interaction period.

Field studies have confirmed the long-term potential for leaching of explosives into the groundwater. An evaluation of the critical parameters affecting the migration of explosives through soils indicated that at a former propellant manufacturing facility, 2,4-DNT leached from soil contaminated with smokeless powder for over 35 years after cessation of operations (USATHAMA, 1985). At another facility, leaching of 2,4-DNT into groundwater from former burning grounds has been documented to occur for as long as 10 years after operations had been discontinued.

Another factor to examine is the tendency of explosives compounds to adsorb to the soil. The compounds considered in this evaluation show K_{oc} values which range from approximately 100 to 500 ml/g. The soils at the deactivation furnace sites (SEAD-16 and SEAD-17) have been shown to possess a high percentage of fines including clay, thereby increasing the sorption potential of these compounds to the soil. As shown in Table 5-3, for the range of K_{oc} exhibited by explosives, i.e., 100-500 ml/g, these compounds would be considered intermediately mobile. Environmental degradation of these parent organic compounds has been shown to occur by various investigators. The information available on this subject is substantial and a detailed discussion is beyond the scope of this document. However, ES has performed a review of the available information which indicates that nitroaromatics and nitroamines are susceptible to environmental transformations. Since some of the byproducts of these transformations may be environmentally persistent, there is a potential for concern.

5.4 CONTAMINANT TRANSPORT AT SEAD-16 AND SEAD-17

5.4.1 Introduction

Constituents detected in samples at SEAD-16 and SEAD-17 were inorganics, SVOCs, Pesticides/PCBs, and explosives compounds. Based on the distributions and concentrations of parameters detected on the sites, inorganics are believed to be the most significant in terms of determining their transport. On this basis, cursory transport modeling of inorganics was performed. This modeling is intended to provide some insight as to which inorganics may pose a future threat to groundwater at both SEAD-16 and SEAD-17. It also may provide the focus and direction for future, more detailed modeling at SEAD-16 and SEAD-17. Transport modeling of the other parameters was not performed for this RI.

Inorganics of concern at SEAD-16 and SEAD-17 are transported primarily by leaching and groundwater flow. Soil and groundwater samples collected during the RI confirm that these materials are present in the surface and subsurface soils as well as in the groundwater. Once these materials have entered the subsurface, they may migrate through the unsaturated vadose zone and/or infiltrate into the groundwater system. A series of publicly available models was used to evaluate the transport of inorganics at SEAD-16 and SEAD-17. These models are used and accepted by USEPA to conservatively estimate soil inorganic contributions to underlying groundwater via the leaching pathway.

5.4.2 Transport Modeling Approach

This modeling effort consisted of the following four steps: 1) development of a conceptual model for transport simulations; 2) estimate the water balance for the site using methods developed by EPA (1975) and Thornthwaite and Mather (1957); 3) estimate the mass impact of selected inorganics on the underlying groundwater using the VLEACH model; and 4) estimate the concentration of the inorganics in the groundwater beneath the site using the SUMMERS model.

The primary goal of this cursory modeling was to evaluate the future impact to groundwater using a base scenario under existing site conditions. The base scenario consists of the best estimates for the parameters required for the VLEACH and SUMMERS models. Also, a sensitivity analysis was performed while running both the VLEACH and SUMMERS models to evaluate the sensitivity of the models to changes in selected input parameters. No attempt was made to calibrate either of the models, because of the lack of applicable subsurface soil and groundwater chemical data in the source areas.

5.4.2.1 Conceptual Model for Transport Simulations

A conceptual model was developed for the transport simulations using the VLEACH and SUMMERS models. The first step was to review the chemical data for inorganics, all geologic conditions, soil physical properties, and ground water levels. Because both SEAD-16 and SEAD-17 are in close proximity to each other, the geologic conditions, soil properties, and aquifer conditions at both sites are very similar. Thus, on the basis of the similarity of the data, a single conceptual model was developed that represents both sites (Figure 5-1). This model is a pictorial representation of the subsurface in the form of a cross-section.

The conceptual model shows the path of migration of inorganics in surface soil to the water table. A percentage of the precipitation that falls on the ground surface percolates through the soil to the water table. The amount of infiltration is calculated by the water balance using methods developed by EPA (1975) and Thornthwaite and Mather (1957). The concentration of inorganics migrating through the soil is a function of their ability to leach from the surface soils and adsorb to the underlying soils. This concentration is calculated by the VLEACH model. Finally, the water entering the aquifer mixes with and is diluted by the water flowing through the aquifer. The final groundwater concentration is calculated by the SUMMERS model.

The depth to bedrock at the site ranges from 4.1 to 8.5 feet below the ground surface in 12 wells at SEAD-16 and SEAD-17. The average depth to bedrock in the 12 wells was 5.8 feet, so the depth to the bottom of the aquifer of 6 feet was used. The depth to water below the ground surface is known to vary seasonally at the sites from a low in the late summer and early fall to a high in the winter and spring, and data to support this was collected during the RI (Section 3.0). Based on the average depth to water for the seasonal high 1.5 feet and the seasonal low 4.3 feet at both SEAD-

16 and SEAD-17, the average depth to water for both sites was calculated to be 3 feet. This provides the basis for the 3 foot depth to water shown in the conceptual model (Figure 5-1).

The chemical data presented in Section 4.0 form the basis for chemical aspects of the conceptual model. This data showed that concentrations of inorganics are highest in the surface soil samples. Their presence is believed to be attributed to the settling of particulates discharged from the nearby deactivation furnaces emission stacks into the air or to surface spills or dumping near the furnace buildings. For this conceptual model, the metal products that were generated during the burning of explosive wastes are most likely be oxides, and these metals, after being discharged from the furnace stacks (possibly associated with particulates), settled onto the ground surface near the buildings. Based on the available historical information, SEAD-16, the older of the two furnaces did not have emission controls when it operated. SEAD-17, however, did have some form of emission controls when it operated. More detailed site histories are presented in Section 1.0.

While it is likely that emissions of metals through the furnace stacks occurred at these sites, the spatial distribution of the highest concentrations of inorganics in surface soils suggests that some of the metals may be attributed to releases during handling of explosive waste; this is especially evident at SEAD-16 where the highest concentrations of inorganics were found between the furnace building (Building S-311) and the Process Support Building (Building 366).

5.4.2.2 Water Balance

The fate and transport of the inorganics is influenced by the interaction with precipitation, the recharge to groundwater and the migration with groundwater. Accordingly, understanding the water balance of the site is helpful in evaluating the contaminant fate and transport at SEAD-16 and SEAD-17. A water balance was developed for this sites using the rational method described in Use of the Water Balance Method for Predicting Leachate Generation from Solid Waste Disposal Sites (EPA, 1975). This procedure calculates the percolation of pore water to groundwater as recharge. Recharge is the difference between the amount of water that infiltrates into the ground minus the actual evapotranspiration and any changes in soil moisture. Infiltration is the difference between precipitation and runoff.

The potential evapotranspiration (PET), was estimated using the procedure described by C.W. Thornthwaite and J.R. Mather in Publications In Climatology, Volume X, Number 3;

Instructions and Tables for Computing Potential Evapotranspiration and the Water Balance, (1957). Evapotranspiration is an estimate of the amount of water which is released from the site through both evaporation and plant uptake (transpiration).

5.4.2.3 VLEACH Model

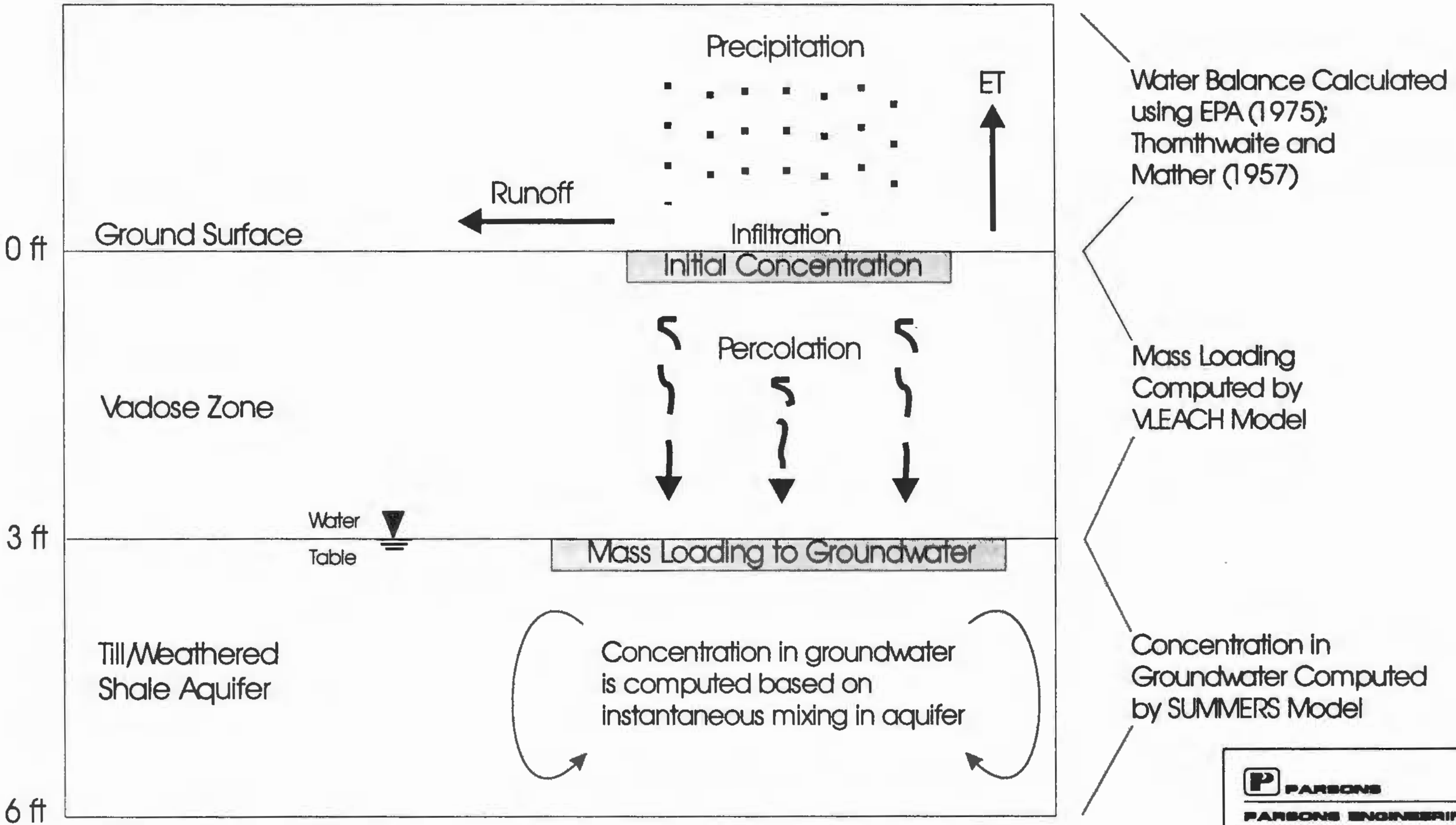
The third step used the VLEACH model, version 2.2a (Ravi and Johnson, 1993) to estimate the mass transport of inorganics through the soil to the water table. The primary output of the VLEACH model is the concentration of the inorganics in both soil and water at the unsaturated-saturated zone interface (i.e., just above the water table).

5.4.2.4 SUMMERS Model

In the last step, the concentrations of inorganics in groundwater below the source areas were estimated using the SUMMERS model, version 1.01, May 1995 (van der Heijde, 1993). The SUMMERS model , which as been used and accepted by the EPA, assumes that a percentage of precipitation (as derived from the water balance) enters the ground and leaches inorganics from the unsaturated soil (as derived from VLEACH), which then reaches the water table. Using a mass balance approach and assuming instantaneous and complete mixing in the aquifer below the source, the SUMMERS model estimates the concentrations of inorganics in the groundwater immediately beneath the source area, assuming no attenuation of the inorganics in the aquifer.

5.4.3 Water Balance

The fate and transport of the constituents of concern is influenced by the interaction with precipitation, the recharge to groundwater and the migration with groundwater. Accordingly, understanding the water balance of the site is helpful in evaluating the contaminant fate and transport at SEAD-16. A water balance was developed for this site using the rational method described in Use of the Water Balance Method for Predicting Leachate Generation from Solid Waste Disposal Sites (EPA, 1975). This procedure calculates the percolation of pore water to groundwater as recharge. Recharge is the difference between the amount of water that infiltrates into the ground minus the actual evapotranspiration and any changes in soil moisture. Infiltration is the difference between precipitation and runoff. The results of these calculations are summarized in Table 5-4.



PARSONS

PARSONS ENGINEERING SCIENCE, INC.

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT ACTIVITY

RI/FS

SEAD-16 AND SEAD-17

DEPT.	DWG NO.
ENVIRONMENTAL ENGINEERING	720477-02000

FIGURE 5-1
CONCEPTUAL MODEL FOR TRANSPORT
SIMULATIONS AT
SEAD-16 AND SEAD-17

SCALE		DATE	
	NA		DECEMBER 1996

GRAPHICS\SENECA\1617TS.CDR

Table 5-4

Monthly Water Balance

SEAD-16 and SEAD-17 Remedial Investigation
Sencca Army Depot Activity

Note	Parameter (units)	January	February	March	April	May	June	July	August	September	October	November	December	Annual
1	Mean Temperature (°F)	22.5	23.4	32.0	44.8	54.5	64.6	69.1	66.9	60.6	50.4	39.4	27.9	46.3
2	Heat Index	0	0	0	1.7	4.0	7.0	8.5	7.8	5.8	2.9	0.7	0.0	38.4
3	Unadjusted PET (in)	0.000	0.000	0.000	0.039	0.079	0.118	0.134	0.126	0.102	0.063	0.024	0.000	
4	Correction Factor	24.6	24.6	30.9	33.6	37.8	38.1	38.4	35.7	31.2	28.5	24.6	23.7	
5	Adjusted PET (in)	0.0	0.0	0.0	1.3	3.0	4.5	5.1	4.5	3.2	1.8	0.6	0.0	24.0
6	P (in)	1.88	2.16	2.45	2.86	3.17	3.70	3.46	3.18	2.95	2.80	3.15	2.57	34.3
7	Corrected P (in)	0	0	7.1	4.8	3.2	3.7	3.5	3.2	3.0	2.8	3.2	0	34.3
8	C R/O	0.22	0.22	0.22	0.22	0.20	0.18	0.18	0.18	0.18	0.18	0.20	0.22	
9	R/O (in)	0.0	0.0	1.6	1.1	0.6	0.7	0.6	0.6	0.5	0.5	0.6	0.0	6.8
10	I (in)	0.0	0.0	5.5	3.8	2.5	3.0	2.8	2.6	2.4	2.3	2.5	0.0	27.5
11	I-PET(in)	0.0	0.0	5.5	2.5	-0.4	-1.5	-2.3	-1.9	-0.8	0.5	1.9	0.0	3.5
12	negative (I-PET)					-0.4	-1.9	-4.2	-6.1	-6.9				
13	ST (in)	3.1	3.1	3.9	3.9	3.5	2.4	1.3	0.8	0.7	1.2	3.1	3.1	
14	delta ST (in)	0.0	0.0	0.8	0.0	-0.4	-1.1	-1.1	-0.5	-0.1	0.5	1.9	0.0	
15	AET (in)	0.0	0.0	0.0	1.3	3.0	4.1	3.9	3.1	2.5	1.8	0.6	0.0	20.4
16	PERC (in)	0.0	0.0	4.7	2.5	0.0	0.0	0.0	0.0	-0.0	0.0	0.0	0.0	7.1

References:
1. Thornthwaite and Mather, 1957. Instructions and Tables for Computing Potential Evapotranspiration and the Water Balance.
2. EPA, 1975. Use of the Water Balance Method for Predicting Leachate Generation from Solid Waste Disposal Sites.
3. Climate of New York Climatography of the United States No.60 National Ocean and Atmospheric Administration, June 1982. Data for Cornell University, Ithaca, NY.

Notes:
1. Mean temperature (from Reference 3)
2. Heat index values (from Tables 1 and 2 of Thornthwaite and Mather, 1957)
3. PET = Potential Evapotranspiration (from Tables 3 and 4 of Thornthwaite and Mather, 1957)
4. Correction factors (from Table 6 of Thornthwaite and Mather, 1957)
5. Adj. PET = Unadj. PET times Correction Factor
6. P = Precipitation (from Reference 3)
7. Corr. P = Corrected precipitation (rain + melting snow)
8. C R/O = Surface Runoff Coefficient (from EPA, 1975)
9. R/O = Surface Runoff
10. I = Infiltration
11. I-PET = Infiltration minus Potential Evapotranspiration
12. neg (I-PET) = Accumulated Potential Water Loss
13. ST = Soil Moisture Storage (Maximum value of 3.9" obtained from Table 10 of Thromthwaite and Mather, 1957., Other values obtained from Table 9 of EPA, 1975.)
14. delta ST = Change in Storage
15. AET = Actual evapotranspiration
16. PERC = Percolation

The potential evapotranspiration (PET), was estimated using the procedure described by C.W. Thornthwaite and J.R. Mather in Publications In Climatology, Volume X, Number 3; Instructions and Tables for Computing Potential Evapotranspiration and the Water Balance, (1957). Evapotranspiration is an estimate of the amount of water which is released from the site through both evaporation and plant uptake (transpiration). The methodology begins by determining the Heat Index, which is obtained from either Table 1 or 2 of the Thornthwaite and Mather (1957) document. Mean monthly temperature data was obtained from the nearby meteorological station, the Aurora Research Farm, which is operated by Cornell University.

The data is shown on Line 1 on Table 5-4. The monthly Heat Indexes are shown on Line 2 of Table 5-4. Heat Indexes are zero when the mean monthly temperature is less than 32^{O}F. From the sum of the monthly Heat Indexes, the unadjusted potential evapotranspiration is obtained from either Table 3 or 4 of the Thornthwaite and Mather document. The unadjusted potential evapotranspiration values are presented on Line 3 of Table 5-4. To change the unadjusted values of potential evapotranspiration into the adjusted monthly potential evapotranspiration, multiply the unadjusted values by a correction factor. The correction factor is expressed in terms of a 12-hour day, which provides an indication of the duration of sunlight for a particular month. Correction factors for the unadjusted potential evapotranspiration are obtained from Table 6 of the same document and depend upon the latitude of the site. This value is presented on Line 4 of Table 5-4. The adjusted Potential Evapotranspiration (PET) is then calculated as the product of Lines 3 and 4 of Table 5-4.

Although site specific precipitation data was not available, monthly precipitation values from the Aurora Research Farm were used. A comprehensive discussion of the weather data is presented in Sections 1.0 and 3.0 of this report.

When the mean monthly temperatures are below 32^{O} F the monthly precipitation values were then corrected to account for precipitation as snowfall in the months of December through March. It was assumed that all of the snowfall remained on the ground as snow, with no evaporation, infiltration, or runoff until March when the snow began to melt. It was also assumed that 60% of the snow (the total precipitation for December, January, and February) melted in March, and therefore entered the water balance as precipitation in addition to the normal monthly precipitation for March. The remaining 40% of the accumulated snowfall was assumed to melt in April.

The total monthly precipitation was then adjusted to account for the percent of water which runs off as overland flow. Line 8, in Table 5-4, contains the Runoff Coefficient, C_{RO}. This coefficient is a measure of the amount of precipitation that will runoff from any given area, and will depend on the soils, vegetation, and slopes found at a site. Generally, C_{RO} values range from 0.05 to 0.35 (EPA, 1975). At SEAD-16, the surface soils are primarily silty clay loams, as described in Section 1. Much of the area is covered with various grasses, though some of the road areas have no vegetative cover. The site slopes generally range from 1 to 3%. For these conditions, the C_{RO} values range from 0.13 (less than 2% slope) to 0.22 (2-7% slopes). Following EPA guidance (1975), a higher C_{RO} (0.22) was used for the cooler months, and a lower value (0.18) was used for the warmer months. For the transitional months, (May and November), a value of 0.20 was used. Infiltration (I), Line 10, is calculated as the difference between the monthly corrected precipitation values, Line 7, and the calculated runoff values, Line 9. Infiltration (Line 10) minus the adjusted potential evapotranspiration values, Line 5, yields I-PET, Line 11. This value was used to assess periods of time when the soil moisture is decreasing. A positive value of I-PET indicates the amount which is available to increase soil moisture or percolate to groundwater. Negative values indicates that potential evapotranspiration exceeds infiltration and there is a net decrease in the soil moisture.

Soil moisture (ST) is a measurement of the available field moisture and is related to soil type. The available moisture is obtained as the difference between the field capacity, i.e. the point at which water will drain by gravity, and the wilting point, i.e. the point at which water is unavailable for plant uptake. For this site, the available soil maps, shown in Section 1 of this report, indicate the soil type to be a silty loam. From Table 10 of the Thornthwaite and Mather (1957) document. The field capacity for a silty loam is approximately 3.6 inches per foot of root zone. The wilting point for a silty loam is approximately 1.2 inches per foot of root zone. The available soil moisture (ST) is the difference of 3.6 and 1.2 inches per foot or 2.4 inches per foot of root zone. The Soil Survey of Seneca County, New York, (April 1972) indicates that the root zone for this area generally ranges from 18 to 24 inches. This analysis used 1.62 feet (19.4 inches) as the root zone, therefore, the ST value used in these calculations was 3.9 inches as shown on Line 13, which was the product of 2.4 inches per foot of root zone and 1.62 feet of root zone. This initial value is assigned to the last month having a positive value of I-PET, which is the month of April. In other words, the last month that the field capacity of the soil was achieved and drainage occurred was April and the value of 3.9 was set for this month. The water balance then proceeded to calculate the ST for the remaining months.

The Actual Evapotranspiration (AET), Line 15, is a calculated value only when the change in soil moisture is negative. The change is soil moisture is presented on Line 14. If the Heat Index, Line 2 is zero then the AET is also zero. In other words when the temperature is below freezing there is no AET. If the ST, Line 13, is equal to the field capacity, which is the maximum value ST can be, then the AET equals the Adjusted PET, Line 5. In other words, the AET is greatest when the soil moisture is maximum. When the change is soil moisture is negative, i.e. the soil moisture is decreasing, the AET is calculated as:

$$AET = PET + (I - PET - \Delta ST)$$

where: *AET* = Actual Evapotranspiration, Line 15;
PET = Adjusted Potential Evapotranspiration, Line 5;
I-PET = Infiltration minus Adjusted Potential Evapotranspiration, Line 11; and
Δ ST = Change in Soil Moisture, Line 14.

Percolation (PERC), Line 16, which is recharge to the groundwater, is calculated as the remainder when the change in soil moisture, Line 14, and the AET, Line 15, is subtracted from I, Line 10. The annual percolation for SEDA is 7.1 inches or 0.59 feet (Table 5-4). This value was used in the VLEACH model, which is described in detail in the following section.

The results of the water balance analysis indicates that much of the runoff and almost all of the percolation (groundwater recharge) occur in March and April, during the snow melt period. There is continued runoff throughout the time period when the temperature stays above freezing, however, recharge is eliminated by the large amount of water that is released to the atmosphere through evapotranspiration. These estimates are consistent with observations made at the site regarding runoff and groundwater. During field operations, runoff was observed following any major rainfall event. This observation is consistent with expectations since the dense clay rich till soils prevent rapid infiltration. At several sites at SEDA, groundwater water levels measured in the spring have historically been the highest, with the levels dropping substantially throughout the summer months. During the course of the year, water level changes of 3 to 4 feet (and as great as 8 feet) have been observed at theses sites. During the late summer and early fall at SEDA, the groundwater table is the lowest, in some instances the water level appears close to the top of the competent bedrock. Water levels measured in the winter have also been lower than those in the spring, indicating little or no sustained recharge to the shallow aquifer occurs in the summer and fall.

Even though the site data and water balance indicate that the water table in the till/weathered shale aquifer fluctuates seasonally, both the VLEACH and SUMMERS models were used to evaluate a "base" condition that use an average water table depth at SEAD-16 and SEAD-17. We believe that the use of an average depth to water is the best way to evaluate the long-term impact (over many tens of years) through leaching to the groundwater at the site.

5.4.4 VLEACH Model

VLEACH is a one-dimensional, finite-difference, vadose zone leaching model. The model allows a site to be divided into a number of two-dimensional polygons, which are vertically divided into a series of user-defined cells. The VLEACH model describes the movement the inorganic constituents within and between three different phases: 1) as a solute dissolved in water; 2) as a gas in the vapor phase; and 3) as an adsorbed compound in the solid phase. Time is segmented into finite periods in each simulation. During each time step, aqueous-phase is advected downward, diffused to the vapor phase and adsorbed to the soil. Equilibrium between the phase occurs according to the distribution coefficients defined for each polygon.

The VLEACH model makes the following assumptions:

1. Linear isotherms describe the partitioning of the inorganic between the liquid, vapor and soil phases.
2. The vadose zone is in a steady-state condition with respect to water movement (i.e., the moisture content profile in the vadose zone is constant).
3. The inorganics are not subject to in situ production of degradation, and
4. Homogeneous soil conditions are assumed to occur within a particular polygon.

The final output of the VLEACH model is the concentration of the inorganics in water percolating downward in the unsaturated zone, at the point where the water is just above the water table. The outputs of the VLEACH model were used in the subsequent SUMMERS model simulations for each of the inorganics selected.

5.4.4.1 VLEACH Model Input Data

The VLEACH model requires input parameters for soil characteristics, partitioning and solubility coefficients for the solute being simulated; input parameters for groundwater flow rate; and input parameters specifying the model geometry and timesteps. A complete list of the input parameters that are described below is provided in Table 5-5.

Soil Properties

The soil parameters required by VLEACH include dry bulk density, volumetric water content, effective porosity and organic carbon water content. A value for dry bulk density of 1.65 grams per cubic centimeter (g/cc) was based on the average for three till soil samples measured at a nearby site at SEDA. The volumetric water content was estimated to be 0.13. According to Ravi and Johnson (1993), the volumetric water content can not be greater than the effective porosity. A value of 20 percent (0.20) was used for the effective porosity of the till, which was estimated based on an average total porosity of 38 percent (0.38) for three till samples collected at a nearby site at SEDA (AEHA Hazardous Waste Study No. 37-26-0479-85, August, 1984). Graphical data provided by Johnson (1967) indicates that the effective porosity is reduced to approximately one half or more of the total porosity in fine-grained soils.

A value of two percent (0.02) was used for the organic carbon content of the soil, which is based on the average total organic carbon content of the surface and subsurface soil samples. As noted in more detail in the following section, while the organic carbon content was held constant in all simulations, the organic carbon distribution coefficient (K_{oc}) was manipulated to yield the soil/water partitioning coefficient (K_d) values used in the model scenarios. K_d is calculated internally by VLEACH.

Solute Properties

The solute properties required by VLEACH include solubility in water, organic carbon distribution coefficient, Henry's constant and free air diffusion coefficient. The input parameters discussed below are for the Base Scenario, which simulates the existing site conditions using the best estimate for the model input parameters.

The soil water partitioning coefficient (K_d) is a parameter that provides and indication of how the metal "distributes" or partitions between the solid phase and the liquid phase. VLEACH was originally designed to predict the migration and fate of organic chemicals and requires a soil organic carbons content and organic carbon distribution coefficient as input parameters. The soil water partitioning coefficient is then internally calculated by VLEACH by multiplying the soil organic carbon content by the organic carbon distribution coefficient (K_{oc}). Thus, the model does not allow direct input of K_d values. Since K_d values were available from published literature, the model was manipulated to allow for the correct calculation of K_d for the metal being simulated. To allow VLEACH to calculate the correct K_d value, the organic carbon content of the soil was held constant and the K_{oc} was varied to yield the desired K_d value.

As a note, the VLEACH model uses solubility only as a flag to indicate whether the solubility of the chemical is exceeded during the simulation.

Although the speciation data is not available for the inorganics, we believe that metal oxides are a likely form for the inorganics due to the nature of the activities at SEAD-16 and SEAD-17. Thus, the solute properties provided below are, were possible, applicable to metal oxides. Input values for the eight inorganics that were modeled are presented below.

VLEACH also requires input values for initial concentration of the solute in soil, the concentration of the solute in the infiltrating water, the concentration of the solute in air, and the background concentration of the solute in the aquifer.

Lead

Lead transport was simulated at both SEAD-16 and SEAD-17 using the parameters defined in Table 5-4. The solubility of an oxide of lead in cold water is 0.0023 grams/100 cc, or 23 mg/l (CRC Handbook of Chemistry and Physics, 1979). Therefore, a solubility value of 23 mg/l was used in the model. A K_d value of 99 ml/g was used for lead (Dragun, 1988), which was achieved in VLEACH by using a K_{oc} value of 4,950 ml/g (Table 5-6). For lead, the Henrys constant and free air diffusion coefficient was set to 0.

The initial concentrations for lead in surface soils were obtained from the chemical data within a distinct source zones (or polygons) at both SEAD-16 and SEAD-17. At these sites, the initial concentrations in the surface soils (model cells 1 and 2) were set equal to the 95th upper concentration limit (UCL) of the lognormal data (51,172,000 µg/kg) and normal data (3,271,630 µg/kg), respectively, that were within the source polygons (Tables 5-7 and 5-8). The initial concentrations in the subsurface soils were set to 9,500 µg/kg, which is the average background concentration of lead in subsurface soil samples collected from borings at MW16-1 and MW17-1.

Table 5-5

VLEACH Model Input Parameters for the Base Scenarios at SEAD-16 and SEAD-17

SEAD-16 and SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Parameter	Model Name	Units	Base Simulation Scenarios							
			Pb-1	Cu-1	Hg-1	Sb-1	As-1	Zn-1	Cd-1	Ag-1
Simulation Data:										
Number of Polygons	NPLOY	dimensionless	1	1	1	1	1	1	1	1
Timestep	DELT	years days	0.02 7	0.02 7	0.02 7	0.02 7	0.02 7	0.02 7	0.02 7	0.02 7
Simulation Time	STIME	years	3,000	1,000	1,000	1,000	1,000	1,000	1,000	1000
Output Time Interval	PTIME	years	10	10	10	10	10	10	10	10
Profile Time Interval	PRTIME	years	10	10	10	10	10	10	10	10
Organic Carbon Distrubution Coefficient (K_{oc})[1]	KOC	ml/g	4,950	1,110	500,000	199,050	165	820	335	5,500
Soil Water Partitioning Coefficient (K_d) [1]	(calc.by model)	ml/g	99	22.2	10,000	3,981	3.3	16.4	6.7	110
Henry's Constant (K_H)	KH	dimensionless	0	0	0	0	0	0	0	0
Water Solubility	CMAX	mg/L	23	6.4	53	12.2	12,000	1.6	10,000	13
Free Air Diffusion Coefficient	DAIR	m^2/day	0	0	0	0	0	0	0	0
Polygon Data:										
Area at SEAD-16	AREA	ft^2	25,550	25,550	7,188	22,250	3,437	26,350	1,750	27,775
Area at SEAD-17	AREA	ft^2	36,935	26,818	NS[2]	39,435	NS[2]	36,780	27,411	NS[2]
Vertical Cell Dimension (cell thickness)	DELZ	ft.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Recharge Rate	Q	ft./year in./year	0.59 7.10	0.59 7.10	0.59 7.10	0.59 7.10	0.59 7.10	0.59 7.10	0.59 7.10	0.59 7.10
Dry Bulk Density	RHOB	g/cc	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65
Effective Porosity	POR	dimensionless	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Volumetric Water Content	THETA	dimensionless	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
Soil Organic Carbon Content (f_{oc})	FOC	dimensionless	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Concentration of Recharge Water	CINF	mg/L	0	0	0	0	0	0	0	0

Table 5-5

VLEACH Model Input Parameters for the Base Scenarios at SEAD-16 and SEAD-17

SEAD-16 and SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Parameter	Model Name	Units	Base Simulation Scenarios							
			Pb-1	Cu-1	Hg-1	Sb-1	As-1	Zn-1	Cd-1	Ag-1
Upper Boundary Condition for Vapor	CATM	mg/L	0	0	0	0	0	0	0	0
Lower Boundary Condition for Vapor	CGW	mg/L	0	0	0	0	0	0	0	0
Cell Number (number of cells in polygon)	NCELL	unitless	30	30	30	30	30	30	30	30
Plot Variable	PLT	unitless	y	y	y	y	y	y	y	y
Plot Time	PLTIME	years	100	100	100	100	100	100	100	100
Initial Contaminant Concentration	XCON	ug/Kg	Table 5-	Table 5-	Table 5-	Table 5-	Table 5-	Table 5-	Table 5-	Table 5-

Notes:

(1) K_d is internally calculated by VLEACH [$K_d = k_{oc} * f_{oc}$]. While f_{oc} and the soil bulk density were fixed, K_{oc} was varied in the simulations to yield a range of K_d values.

(2) NS = Not Simulated.

Table 5-6

Soil Water Distribution Coefficients (K_d)s for Selected Inorganics [(1)] Used in the VLEACH Model

SEAD-16 and SEAD-17 Remedial Investigation
Seneca Army Depot Acitvity

Selected Metal	Dragun (1988)				Looney et al. (1975)	
	Observed Range (ml/g)	One Standard Deviation Low (ml/g)	Mean (ml/g)	One Standard Deviation High (ml/g)	Observed Range (ml/g)	Recommended Value (ml/g)
Antimony	-	-	-	-	100 - 10,000	3,981
Arsenic	1 - 8.3	1.8	3.3	6.0	-	-
Cadmium	1.3 - 27	2.7	6.7	16.4	-	-
Copper	1.4 - 333	7.4	22.2	66.7	-	-
Lead	4.5 - 7,640	18	99	549	-	-
Mercury	-	-	-	-	NA	10,000
Silver	10 - 1,000	30	110	403	-	-
Zinc	0.1 - 8,000	2.5	16.4	109.9	-	-

Notes:

(1) Ranges of soil water distribution coefficients (K_ds) were obtained from Table 4-2 of Dragun (1988) and Table 1 of Looney et al. (1975). Dragun (1988) provided data to calculate one standard deviation low and one standard deviation high; these values could not be derived from the Looney data.

NA = Not Available.

Table 5-7

VLEACH Model Inputs for Initial Concentrations of Inorganics in Surface Soil and Definition of Source Polygons at SEAD-16

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Depth		Cell	Initial Concentration[1]						
Top (feet)	Bottom (feet)	Number in Polygon	Lead (ug/Kg)	Copper (ug/Kg)	Mercury (ug/Kg)	Antimony (ug/Kg)	Arsenic (ug/Kg)	Zinc (ug/Kg)	Cadmium (ug/Kg)
0	0.1	1	51,172,000	13,399,000	6,990	1,673,320	23,530	3,749,820	16,600
0.1	0.2	2	51,172,000	13,399,000	6,990	1,673,320	23,530	3,749,820	16,600
0.2	0.3	3	9,500	23,500	40	5,200	4,300	68,650	325
0.3	0.4	4	9,500	23,500	40	5,200	4,300	68,650	325
0.4	0.5	5	9,500	23,500	40	5,200	4,300	68,650	325
0.5	0.6	6	9,500	23,500	40	5,200	4,300	68,650	325
0.6	0.7	7	9,500	23,500	40	5,200	4,300	68,650	325
0.7	0.8	8	9,500	23,500	40	5,200	4,300	68,650	325
0.8	0.9	9	9,500	23,500	40	5,200	4,300	68,650	325
0.9	1	10	9,500	23,500	40	5,200	4,300	68,650	325
1	1.1	11	9,500	23,500	40	5,200	4,300	68,650	325
1.1	1.2	12	9,500	23,500	40	5,200	4,300	68,650	325
1.2	1.3	13	9,500	23,500	40	5,200	4,300	68,650	325
1.3	1.4	14	9,500	23,500	40	5,200	4,300	68,650	325
1.4	1.5	15	9,500	23,500	40	5,200	4,300	68,650	325
1.5	1.6	16	9,500	23,500	40	5,200	4,300	68,650	325
1.6	1.7	17	9,500	23,500	40	5,200	4,300	68,650	325
1.7	1.8	18	9,500	23,500	40	5,200	4,300	68,650	325
1.8	1.9	19	9,500	23,500	40	5,200	4,300	68,650	325
1.9	2	20	9,500	23,500	40	5,200	4,300	68,650	325
2	2.1	21	9,500	23,500	40	5,200	4,300	68,650	325
2.1	2.2	22	9,500	23,500	40	5,200	4,300	68,650	325
2.2	2.3	23	9,500	23,500	40	5,200	4,300	68,650	325
2.3	2.4	24	9,500	23,500	40	5,200	4,300	68,650	325
2.4	2.5	25	9,500	23,500	40	5,200	4,300	68,650	325
2.5	2.6	26	9,500	23,500	40	5,200	4,300	68,650	325
2.6	2.7	27	9,500	23,500	40	5,200	4,300	68,650	325
2.7	2.8	28	9,500	23,500	40	5,200	4,300	68,650	325
2.8	2.9	29	9,500	23,500	40	5,200	4,300	68,650	325
2.9	3	30	9,500	23,500	40	5,200	4,300	68,650	325
		Number	Loc. ID.	Loc. ID.	Loc. ID.	Loc. ID.	Loc. ID.	Loc. ID.	Loc. ID.
P	D	1	SS16-2	SS16-2	SS16-2	SS16-2	SS16-2	SS16-2	SS16-3
o	e	2	SS16-3	SS16-3	SS16-3	SS16-3	SS16-3	SS16-3	SS16-26
l	f	3	SS16-4	SS16-4	SS16-5	SS16-4	SS16-26	SS16-4	SS16-27
y	i	4	SS16-5	SS16-5	SS16-22	SS16-5	SS16-27	SS16-5	
g	n	5	SS16-21	SS16-21	SS16-23	SS16-21		SS16-21	
o	i	6	SS16-22	SS16-22	SS16-26	SS16-22		SS16-22	
n	t	7	SS16-23	SS16-26	SS16-27	SS16-26		SS16-23	
	i	8	SS16-26	SS16-27	SS16-30	SS16-27		SS16-24	
	o	9	SS16-27	SS16-28		SS16-28		SS16-26	
	n	10	SS16-28	SS16-30		SS16-30		SS16-27	
		11	SS16-30					SS16-28	
		12						SS16-30	
Area of Polygon (ft^2):			25,550	25.550	7,188	22,250	3,437	26,350	1,750

Note:

(1) Initial concentrations of inorganics shown in cells 1 and 2 are the 95th UCL of the normal data or the 95th UCL of the log transformed data that are within the source areas defined for the individual inorganics. Initial concentrations of inorganics in cells 3 through 30 are the are the average of subsurface soil samples from background locations MW16-1 and MW17-1.

Table 5-8

VLEACH Model Inputs for Initial Concentrations of Inorganics in Surface Soil and Definition of Source Polygons at SEAD-17

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Depth		Cell	Initial Concentration [1]					
Top (feet)	Bottom (feet)	Number in Polygon	Lead (ug/Kg)	Copper (ug/Kg)	Antimony (ug/Kg)	Zinc (ug/Kg)	Silver (ug/Kg)	Cadmium (ug/Kg)
0	0.1	1	3,271,630	599,270	41,190	932,080	5,790	14,180
0.1	0.2	2	3,271,630	599,270	41,190	932,080	5,790	14,180
0.2	0.3	3	9,500	23,500	5,200	68,650	650	325
0.3	0.4	4	9,500	23,500	5,200	68,650	650	325
0.4	0.5	5	9,500	23,500	5,200	68,650	650	325
0.5	0.6	6	9,500	23,500	5,200	68,650	650	325
0.6	0.7	7	9,500	23,500	5,200	68,650	650	325
0.7	0.8	8	9,500	23,500	5,200	68,650	650	325
0.8	0.9	9	9,500	23,500	5,200	68,650	650	325
0.9	1	10	9,500	23,500	5,200	68,650	650	325
1	1.1	11	9,500	23,500	5,200	68,650	650	325
1.1	1.2	12	9,500	23,500	5,200	68,650	650	325
1.2	1.3	13	9,500	23,500	5,200	68,650	650	325
1.3	1.4	14	9,500	23,500	5,200	68,650	650	325
1.4	1.5	15	9,500	23,500	5,200	68,650	650	325
1.5	1.6	16	9,500	23,500	5,200	68,650	650	325
1.6	1.7	17	9,500	23,500	5,200	68,650	650	325
1.7	1.8	18	9,500	23,500	5,200	68,650	650	325
1.8	1.9	19	9,500	23,500	5,200	68,650	650	325
1.9	2	20	9,500	23,500	5,200	68,650	650	325
2	2.1	21	9,500	23,500	5,200	68,650	650	325
2.1	2.2	22	9,500	23,500	5,200	68,650	650	325
2.2	2.3	23	9,500	23,500	5,200	68,650	650	325
2.3	2.4	24	9,500	23,500	5,200	68,650	650	325
2.4	2.5	25	9,500	23,500	5,200	68,650	650	325
2.5	2.6	26	9,500	23,500	5,200	68,650	650	325
2.6	2.7	27	9,500	23,500	5,200	68,650	650	325
2.7	2.8	28	9,500	23,500	5,200	68,650	650	325
2.8	2.9	29	9,500	23,500	5,200	68.650	650	325
2.9	3	30	9,500	23,500	5,200	68,650	650	325
		Number	Loc. ID.	Loc. ID.	Loc. ID.	Loc. ID.	Loc. ID.	Loc. ID.
Polygon	Definition	1	SS17-4	SS17-6	SS17-9	SS17-6	SS17-6	SS17-6
		2	SS17-6	SS17-7	SS17-10	SS17-7	SS17-8	SS17-7
		3	SS17-7	SS17-8	SS17-13	SS17-8	SS17-9	SS17-8
		4	SS17-8	SS17-10	SS17-18	SS17-10	SS17-10	SS17-9
		5	SS17-9	SS17-13	SS17-27	SS17-12	SS17-13	SS17-13
		6	SS17-12	SS17-14	SS17-37	SS17-13	SS17-14	SS17-14
		7	SS17-13	SS17-18		SS17-14	SS17-18	SS17-18
		8	SS17-14	SS17-27		SS17-18	SS17-27	SS17-27
		9	SS17-18	SS17-37		SS17-27	SS17-37	SS17-28
		10	SS17-27			SS17-28		SS17-37
		11	SS17-37			SS17-37		
Area of Polygon (ft^2):			36,935	26,818	39,435	36,780	27,775	27,411

Note:

(1) Initial concentrations of inorganics shown in cells 1 and 2 are the 95th UCL of the normal data or the 95th UCL of the log transformed data that are within the source areas defined for the individual inorganics. Initial concentrations of inorganics in cells 3 through 30 are the are the average of subsurface soil samples from background locations MW16-1 and MW17-1.

The concentration of lead in the recharge water was set to 0 mg/l. The upper and lower boundary conditions for vapor were set to 0 mg/l.

Copper

Copper transport was simulated at both SEAD-16 and SEAD-17 using the parameters defined in Table 5-5. The solubility of copper is listed as 1.0 x 10-4 moles/l, which is the solubility of the estimated sum of species dissolved in solution (Looney et al., 1975). Therefore, after converting the desired units, a solubility value of 12.18 mg/l was used in the model. A K_d value of 22.2 ml/g was used for copper (Dragun, 1988), which was achieved in VLEACH by using a K_{oc} value of 1,110 ml/g (Table 5-6). For copper, the Henrys constant and free air diffusion coefficient was set to 0.

The initial concentrations for copper in surface soils were obtained from the chemical data within a distinct source zones (or polygons) at both SEAD-16 and SEAD-17. At these sites, the initial concentrations in the surface soils (model cells 1 and 2) were set equal to the 95th UCL of the lognormal data (13,399,000 µg/kg) and normal data (599,270 µg/kg), respectively, that were within the source polygons (Tables 5-7 and 5-8). The initial concentrations in the subsurface soils were set to 23,500 µg/kg, which is the average background concentration of copper in subsurface soil samples collected from borings at MW16-1 and MW17-1.

The concentration of copper in the recharge water was set to 0 mg/l. The upper and lower boundary conditions for vapor were set to 0 mg/l.

Mercury

Mercury transport was simulated at only SEAD-16 using the parameters defined in Table 5-5. The solubility of an oxide of mercury in cold water is 0.0053 grams/100 cc, or 53 mg/l (CRC Handbook of Chemistry and Physics, 1979). Therefore, a solubility value of 53 mg/l was used in the model. Dragun (1988) did not list a K_d value for mercury, so a recommended value of 10,000 ml/g was obtained from Looney et al. (1975). This K_d value was obtained in VLEACH by using a K_{oc} value of 500,000 ml/g (Table 5-6). For mercury, the Henrys constant and free air diffusion coefficient was set to 0.

The initial concentrations for mercury in surface soils were obtained from the chemical data within a distinct source zone (or polygon) at SEAD-16. The initial concentrations in the surface soils (model cells 1 and 2) were set equal to the 95th UCL of the lognormal data (6,990 μg/kg) that were within the source polygon (Table 5-7). The initial concentrations in the subsurface soils were set to 40 μg/kg, which is the average background concentration of mercury in subsurface soil samples collected from borings at MW16-1 and MW17-1.

The concentration of mercury in the recharge water was set to 0 mg/l. The upper and lower boundary conditions for vapor were set to 0 mg/l.

Antimony

Antimony transport was simulated at both SEAD-16 and SEAD-17 using the parameters defined in Table 5-5. The solubility of antimony is listed as 1.0 x 10-4 moles/l, which is the solubility of the estimated sum of species dissolved in solution (Looney et al., 1975). Therefore, after converting the desired units, a solubility value of 6.35 mg/l was used in the model. A K_d value of 3,981 ml/g was used for antimony (Dragun, 1988), which was achieved in VLEACH by using a K_{oc} value of 199,050 ml/g (Table 5-6). For antimony, the Henrys constant and free air diffusion coefficient was set to 0.

The initial concentrations for antimony in surface soils were obtained from the chemical data within a distinct source zones (or polygons) at both SEAD-16 and SEAD-17. At these sites, the initial concentrations in the surface soils (model cells 1 and 2) were set equal to the 95th UCL of the lognormal data (1,673,320 μg/kg) and normal data (41,190 μg/kg), respectively, that were within the source polygons (Tables 5-7 and 5-8). The initial concentrations in the subsurface soils were set to 5,200 μg/kg, which is the average background concentration of antimony in subsurface soil samples collected from borings at MW16-1 and MW17-1.

The concentration of antimony in the recharge water was set to 0 mg/l. The upper and lower boundary conditions for vapor were set to 0 mg/l.

Arsenic

Arsenic transport was simulated at only SEAD-16 using the parameters defined in Table 5-5. The solubility of an oxide of arsenic in cold water is 1.2 grams/100 cc, or 12,000 mg/l (CRC Handbook of Chemistry and Physics, 1979). Therefore, a solubility value of 12,000 mg/l was used in the model. A K_d value of 3.3 ml/g was used for arsenic (Dragun, 1988), which was achieved in

VLEACH by using a K_{oc} value of 165 ml/g (Table 5-6). For arsenic, the Henrys constant and free air diffusion coefficient was set to 0.

The initial concentrations for arsenic in surface soils were obtained from the chemical data within a distinct source zone (or polygon) at SEAD-16. The initial concentrations in the surface soils (model cells 1 and 2) were set equal to the 95th UCL of the normal data (23,530 µg/kg) that were within the source polygon (Table 5-7). The initial concentrations in the subsurface soils were set to 4,300 µg/kg, which is the average background concentration of lead in subsurface soil samples collected from borings at MW16-1 and MW17-1.

The concentration of arsenic in the recharge water was set to 0 mg/l. The upper and lower boundary conditions for vapor were set to 0 mg/l.

Zinc

Zinc transport was simulated at both SEAD-16 and SEAD-17 using the parameters defined in Table 5-5. The solubility of an oxide of zinc in cold water is 0.00016 grams/100 cc, or 1.6 mg/l (CRC Handbook of Chemistry and Physics, 1979). Therefore, a solubility value of 1.6 mg/l was used in the model. A K_d value of 16.4 ml/g was used for lead (Dragun, 1988), which was achieved in VLEACH by using a K_{oc} value of 820 ml/g (Table 5-6). For zinc, the Henrys constant and free air diffusion coefficient was set to 0.

The initial concentrations for zinc in surface soils were obtained from the chemical data within a distinct source zones (or polygons) at both SEAD-16 and SEAD-17. At these sites, the initial concentrations in the surface soils (model cells 1 and 2) were set equal to the 95th UCL of the lognormal data (3,749,820 µg/kg) and normal data (932,080 µg/kg), respectively, that were within the source polygons (Tables 5-7 and 5-8). The initial concentrations in the subsurface soils were set to 68.650 µg/kg, which is the average background concentration of zinc in subsurface soil samples collected from borings at MW16-1 and MW17-1.

The concentration of zinc in the recharge water was set to 0 mg/l. The upper and lower boundary conditions for vapor were set to 0 mg/l.

Cadmium

Cadmium transport was simulated at both SEAD-16 and SEAD-17 using the parameters defined in Table 5-5. Oxide of cadmium are listed as insoluble in CRC Handbook of Chemistry and Physics (1979), however, Looney et al. (1975), while not providing a value for solubility, indicate that the solubility of cadmium does not limit transport. A solubility value of approximately 10,000 mg/l was obtained for the hydroxide form of cadmium. A K_d value of 6.7 ml/g was used for cadmium (Dragun, 1988), which was achieved in VLEACH by using a K_{oc} value of 335 ml/g (Table 5-6). For cadmium, the Henrys constant and free air diffusion coefficient was set to 0.

The initial concentrations for cadmium in surface soils were obtained from the chemical data within a distinct source zones (or polygons) at both SEAD-16 and SEAD-17. At these sites, the initial concentrations in the surface soils (model cells 1 and 2) were set equal to the 95th UCL of the normal data (16,600 µg/kg and 14,180 µg/kg, respectively) that were within the source polygons (Tables 5-7 and 5-8). The initial concentrations in the subsurface soils were set to 325 µg/kg, which is the average background concentration of cadmium in subsurface soil samples collected from borings at MW16-1 and MW17-1.

The concentration of cadmium in the recharge water was set to 0 mg/l. The upper and lower boundary conditions for vapor were set to 0 mg/l.

Silver

Silver transport was simulated at only SEAD-17 using the parameters defined in Table 5-4. The solubility of an oxide of silver in cold water is 0.0013 grams/100 cc, or 13 mg/l (CRC Handbook of Chemistry and Physics, 1979). Therefore, a solubility value of 13 mg/l was used in the model. A K_d value of 110 ml/g was used for silver (Dragun, 1988), which was achieved in VLEACH by using a K_{oc} value of 5,500 ml/g (Table 5-6). For silver, the Henrys constant and free air diffusion coefficient was set to 0.

The initial concentrations for arsenic in surface soils were obtained from the chemical data within a distinct source zone (or polygon) at SEAD-17. The initial concentrations in the surface soils (model cells 1 and 2) were set equal to the 95th UCL of the normal data (5,790 µg/kg) that were within the source polygon (Table 5-8). The initial concentrations in the subsurface soils were set to 650 µg/kg, which is the average background concentration of silver in subsurface soil samples collected from borings at MW16-1 and MW17-1.

The concentration of sliver in the recharge water was set to 0 mg/l. The upper and lower boundary conditions for vapor were set to 0 mg/l.

Recharge Rate

The recharge rate for the VLEACH modeling was set equal to 0.59 feet/year, which is the infiltration rate calculated in the water balance (Table 5-5).

Model Geometry and Time Steps

VLEACH calculates only the vertical movement of a solute through each polygon, and it does not allow the solute to be exchange laterally between polygons. Therefore, as a conservative assumption, a single polygon, with the surface soil concentration set equal to the 95th UCL within the source area, was used in the VLEACH simulations (Table 5-5). The boundary of the source polygon for each inorganic was selected subjectively based on the observed concentrations in surface soils, with the intent of capturing the highest set of concentrations.

Based on the measured depths to water at three different times that represent the lowest and highest water tables at both SEAD-16 and SEAD-17, an average depth to water of 3 feet below the ground surface was chosen for the model. The source polygon was divided into 0.1-foot-thick cells resulting in a total 30 vertical cells. A total simulation time of 1,000 years was used for each of the inorganics, except lead for which a time of 3,000 years was used (Table 5-5).

5.4.4.2 VLEACH Model Results

SEAD-16

The results of the VLEACH modeling for SEAD-16 yields the maximum leaching concentrations of each of the seven inorganics simulated at a depth immediately above the water table (Table 5-9). It is noteworthy that in the VLEACH simulations for lead, copper, and zinc the solubility was exceeded in several vertical cells of the polygon because of the large initial soil concentrations. This also resulted in final leaching concentrations that were above the estimated solubility for the respective metals, noting that the exact speciation of metals at SEAD-16, and thus the solubility, is not known. Considering that the solubility estimates for the metals are approximate, the aqueous concentrations of these metals calculated by VLEACH can be considered to be conservative.

These result indicate that the highest leaching concentrations were for lead and copper (55.73 mg/l and 65.27 mg/l, respectively), each of which is above its applicable groundwater standard. The times at which the maximum leaching concentrations would occur according to the VLEACH model are 785 years for lead and 170 years for copper.

The maximum leaching concentrations of several other metals (arsenic, zinc, and cadmium) were also above their respective groundwater standards (Table 5-9). According to the VLEACH model results, the times at which these maximums would occur ranged between 20 and 130 years. The leaching concentrations for antimony and mercury were below their respective standards.

These maximum leaching concentrations were used as conservative input parameters into the SUMMERS Model to calculate the concentrations of the various inorganics in the aquifer as a result of instantaneous mixing. By using the maximum leaching concentrations a worst-case impact for each of the inorganics could be evaluated.

SEAD-17

The results of the VLEACH modeling at SEAD-17 yields the maximum leaching concentrations of each of the six inorganics simulated at a depth immediately above the water table (Table 5-10). In the VLEACH simulations for lead and zinc, the solubility was exceeded in several of the vertical cells in the polygon because of the large initial soil concentrations. This also resulted in a final leaching concentration for zinc that was above its estimated solubility, noting that the exact speciation of metals at SEAD-16, and thus the solubility, is not known. Considering that the solubility estimates for the metals are approximate, the aqueous concentrations of these metals calculated by VLEACH can be considered to be conservative.

Table 5-9

Maximum Leaching Concentrations of Inorganics to Groundwater for the Base Scenarios at SEAD-16

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Parameter	Predicted Maximum Leaching Concentration using VLEACH Model (mg/L)	Predicted Time of Maximum Leaching Concentration using VLEACH Model (year)
Lead (1)	55.73	785
Copper (1)	65.27	175
Antimony	0.00131	0
Arsenic	1.48	20
Mercury	0.00000	0
Zinc (1)	26.45	130
Cadmium	0.28	55

Notes:

(1) The predicted maximum leaching concentration exceeds the estimated solubility of this metal at SEAD-16, so this value is conservative.

Table 5-10

Maximum Leaching Concentrations of Inorganics to Groundwater for the Base Scenarios at SEAD-17

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Parameter	Predicted Maximum Leaching Concentration using VLEACH Model (mg/L)	Predicted Time of Maximum Leaching Concentration using VLEACH Model (year)
Lead	3.60	785
Copper	3.41	170
Antimony	0.00131	0
Zinc (1)	8.20	120
Silver	0.01	780
Cadmium	0.25	55

Notes:

(1) The predicted maximum leaching concentration exceeds the estimated solubility of this metal at SEAD-17, so this value is conservative.

These result indicate that the highest leaching concentration was for zinc (8.20 mg/l) and the concentrations for lead and copper were the next highest at 3.60 mg/l and 3.41 mg/l, respectively. All three of these concentrations are above their applicable groundwater standards. While the times at which the maximum leaching concentrations would occur for copper and zinc were between 120 and 170 years, the time for the lead maximum was predicted at 785 years.

The maximum leaching concentration of cadmium was also above its respective groundwater standard (at 55 years). Maximum leaching concentrations for antimony and silver were below their respective standards (Table 5-10).

These maximum leaching concentrations were used as conservative input parameters into the SUMMERS Model to calculate the concentrations of the various inorganics in the aquifer as a result of instantaneous mixing. By using the maximum leaching concentrations a worst-case impact for each of the inorganics could be evaluated.

5.4.4.3 VLEACH Model Sensitivity Analysis

A sensitivity analysis was performed to evaluate the impact of various input parameters on the mass loading to groundwater at both SEAD-16 and SEAD-17. The parameters evaluated were distribution coefficient (K_d) [i.e., through manipulation of K_{oc} and fraction of organic carbon (f_{oc})] and infiltration velocity (Q). These parameters were chosen because, based on a sensitivity analysis presented in the VLEACH manual (Ravi and Johnson, 1993), these two parameters have the greatest impact on both soil concentrations and groundwater loading. Their analysis found that bulk density and porosity have a significant impact only on soil contaminant level, and the rest of the parameters have no significant impact on either soil concentrations or groundwater loading.

The sensitivity analysis was performed by using values for K_d and Q that were below (low) and above (high) the value that was determined to represent the "base" scenario, or best estimate scenario. Thus, each inorganic was evaluated over three different scenarios (i.e., base, low and high). For Kd, the low and high scenarios were based on one standard deviation above and one standard deviation below the mean values cited by Dragun (1988). For Q, the high and low values are 50 percent and 150 percent of the base value, which was determined for the water balance in Section 5.4.3.

The results of the sensitivity analysis are summarized on Tables 5-11 and 5-12. The input data for all of the sensitivity runs are contained in Appendix H. The concentrations of metals in water percolating through the unsaturated zone as calculated by VLEACH are sensitive and inversely proportional to K_d. Also, these results show that the concentrations of metals in percolating water are sensitive and proportional to Q. The values of K_d and Q have opposite impacts on the calculated maximum leaching concentrations. Thus, high K_d values result in lower maximum leaching concentrations compared to the base, whereas high Q values result in higher concentrations. On the basis of these results, the low and high values of K_d resulted in the widest range of calculated concentrations; this is especially apparent for lead. Complete sensitivity analysis results are contained in Appendix H.

5.4.5 SUMMERS

The SUMMERS model is based upon equations developed by K.S. Summers (USEPA, 1989). This model estimates the concentration of a dissolved substance in an aquifer. The model assumes that the solute is introduced at the top of the aquifer at a specified mass loading rate. The model then calculates the concentration of the solute in the aquifer by assuming that the solute is instantaneously mixed in the aquifer beneath the source area. The mass balance approach computes the concentration in the aquifer using the following equation (Summers et al. 1980):

$$C = \frac{Q_p C_p + Q_a C_a}{Q_p + Q_a}$$

where:

C = resulting concentration in aquifer,
Q_p = volumetric flow rate of liquid transporting pollutant in to aquifer,
C_p = concentration of pollutant at upper boundary of the aquifer,
Q_a = volumetric flow rate of aquifer, and
C_a = initial background concentration of pollutant in aquifer.

Table 5-11

Results of VLEACH Senstivity Analysis for Selected Inorganics at SEAD-16

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Inorganic	Parameter	Maximum Leaching Concentration (mg/l)		
		low	base	high
Pb	Kd	305.12	55.73	0.00025
	years	145	785	3000
	Q	31.45	55.73	74.90
	years	1605	785	525
Cu	Kd	194.66	65.27	21.79
	years	60	175	530
	Q	36.78	65.27	87.72
	years	360	175	120
Sb	Kd	NA	0.00131	NA
	years	NA	0	NA
	Q	0.00064	0.00131	0.00064
	years	0	0	0
As	Kd	2.56	1.48	0.84
	years	10	20	40
	Q	0.77	1.48	2.15
	years	45	20	15
Hg	Kd	NA	0.00000	NA
	years	NA	0	NA
	Q	0.00000	0.00000	0.00001
	years	0	0	0
Zn	Kd	170.05	26.45	3.96
	years	20	130	860
	Q	14.76	26.45	35.90
	years	265	130	85
Cd	Kd	0.67	0.28	0.12
	years	20	55	130
	Q	0.16	0.28	0.39
	years	110	55	35

Table 5-12

Results of VLEACH Senstivity Analysis for Selected Inorganics at SEAD-17

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Inorganic	Parameter	Maximum Leaching Concentration (mg/l)		
		low	base	high
Pb	Kd	19.72	3.60	0.28
	years	145	785	3000
	Q	2.03	3.60	4.85
	years	1600	785	525
Cu	Kd	10.07	3.41	1.14
	years	55	170	510
	Q	1.88	3.41	4.66
	years	350	170	115
Sb	Kd	NA	0.00131	NA
	years	NA	0	NA
	Q	0.00064	0.00131	0.00195
	years	0	0	0
Zn	Kd	52.01	8.20	1.23
	years	20	120	810
	Q	4.45	8.20	11.41
	years	250	120	80
Ag	Kd	0.032	0.009	0.002
	years	215	780	1000
	Q	0.003	0.009	0.012
	years	1000	780	505
Cd	Kd	0.59	0.25	0.10
	years	20	55	130
	Q	0.14	0.25	0.34
	years	110	55	35

5.4.5.1 SUMMERS Model Input Data

Mass Loading Parameters

The mass loading parameters used by the SUMMERS model include seepage velocity in the downward direction, saturated void fraction in soil, horizontal area of the surface soil source zone (or polygon), and the concentration of the solute in the infiltration at the unsaturated-saturated zone interface. Input parameters for the SUMMERS model are provide in Tables 5-13 and 5-14.

The seepage velocity in the downward direction was calculated to be 0.0016 feet/day using the infiltration rate derived in the water balance (Tables 5-13 and 5-14). The saturated void fraction of the soil was estimated to be 0.2, which is equal to the effective porosity of the till. Because this value is used by the SUMMERS model to calculate the specific discharge (or Darcy velocity) in the downward direction, it is essentially equivalent to the effective porosity, and thus, this value was believed to be appropriate. The horizontal area of the surface soil source zone was the same as that used in the VLEACH model for each of the selected inorganics. Finally, the concentration of the solute in the infiltration at the unsaturated-saturated zone interface was calculated by the VLEACH model (Tables 5-13 and 5-14).

Aquifer Parameters

The aquifer parameters are used by the SUMMERS model to calculate the volume of water in the aquifer to be mixed with the volume of infiltrating water. These parameters include horizontal seepage velocity (Darcy velocity), porosity, aquifer thickness, and width of flow beneath the source zone (i.e., polygon). Input parameters for the SUMMERS model are provide in Tables 5-13 and 5-14.

The horizontal seepage velocity was specified as 0.93 feet/day. This velocity is the same that was calculated in Section 3.0. for the till/weathered shale aquifer. The effective porosity of the aquifer was specified as 0.2 (see Section 3.0), the same that was used in the VLEACH model.

An aquifer thickness of 3 feet was used, which is consistent with the conceptual model. The derivation of this value is provided in the discussion of the conceptual model (Section 5-4).
The width of the flow (the length in feet of the source polygon perpendicular to the direction of groundwater flow) used in the SUMMERS model was depended on the size of the source polygon defined in VLEACH for each of the eight inorganics (Tables 5-13 and 5-14).

5.4.5.2 SUMMERS Model Results

The predicted concentrations of metals in groundwater represent worst-case concentrations that are vertically mixed within the aquifer directly beneath the soil source polygons (areas) defined for each of the metals. The SUMMERS model does not simulate lateral movement of groundwater toward property boundaries nor does it simulate partitioning of the metals within the aquifer. Therefore, attenuation of the metals in the aquifer was not modeled. An example of the output from the SUMMERS model is contained in Appendix H.

SEAD-16

The results of the SUMMERS modeling for SEAD-16 yields the concentrations of the seven inorganics in the aquifer immediately below the source polygon, assuming instantaneous mixing (Table 5-15). The concentrations calculated by SUMMERS are a worst-case impact for each of the seven inorganics in the base scenario, which uses the best estimates for all input parameters.

The modeling results indicate that at various times in the future lead, copper and zinc may exceed their respective groundwater standards in the aquifer (Table 5-15). The model predicts that lead will reach a maximum concentration in the aquifer of 2,721 μg/l in approximately 785 years. This concentration exceeds the EPA MCL (which is actually a guidance value) of 15 μg/l for lead. In addition, the model predicts that it will take approximately 205 years before the MCL for lead is exceeded. The maximums concentrations for copper and zinc are predicted to be 3,190 μg/l (in 175 years) and 1,428 μg/l (in 130 years), which are also above their respective standards of 200 μg/l and 300 μg/l. And, the model results indicate that it will take 85 years and 65 years to before the groundwater standards for copper and zinc, respectively, are exceeded.

The concentrations of the other metals (antimony, arsenic, mercury, and cadmium) were predicted to be below their respective groundwater standards.

In summary, the SUMMERS model results provide insight as to the inorganics that are likely to pose a future threat to groundwater at SEAD-16. And, considering that the leaching concentrations of the metals calculated by VLEACH are estimates, (due to the uncertainty

Table 5-13

Summers Model Input Parameters and Results for Base Scenarios of Seven Inorganics at SEAD-16

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Parameter	Model I.D.	Units	Model Scenario						
			Pb-1	Cu-1	Sb-1	As-1	Hg-1	Zn-1	Cd-1
Seepage velocity in downward direction	Vsz	ft/day	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016
Saturated void fraction (water volume/volume of solid) in soil	E	unitless	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Specific discharge (Darcy velocity) in the downward Direction	Vdz	ft/day	0.00032	0.00032	0.00032	0.00032	0.00032	0.00032	0.00032
Horizontal area of impacted soil	Ap	ft^2	25,550	25,550	22,250	3,437	7,188	26,350	1,750
Volumetric flow rate of liquid transporting solute into the aquifer (unsaturated-saturated zone interface)	Qp	ft^3/day	8.18	8.18	7.12	1.10	2.30	8.43	0.56
Seepage velocity in aquifer	Vsa	ft/day	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Porosity of aquifer (fraction)	Ea	unitless	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Specific discharge (Darcy velocity) in the aquifer	Vda	ft/day	0.186	0.186	0.186	0.186	0.186	0.186	0.186
Thickness of aquifer	Ha	ft	3	3	3	3	3	3	3
Width of impacted soil perpendicular to flow direction in the aquifer	Wp	ft	320	320	305	140	300	300	95
Volumetric flow rate of aquifer	Qa	ft^3/day	178.56	178.56	170.19	78.12	167.4	167.4	53.01
Initial or background concentration of solute in the aquifer	Cs	mg/l	0.00085	0.0049	0.001	0.00125	0.00005	0.0156	0.00015
Concentration of solute in the infiltration at the unsaturated-saturated zone interface calculated by VLEACH model	Cp	mg/l	55.73	65.27	0.00131	1.48	0.00000	26.45	0.28
Solute concentration in groundwater as calculated by the SUMMERS model	Cgw	mg/l	2.44	2.86	0.00101	0.02	0.00005	1.28	0.0031
	Cgw	ug/l	2,441	2,862	1.01	22	0.05	1,283	3.08

Table 5-14

Summers Model Input Parameters and Results for Base Scenarios of Six Inorganics at SEAD-17

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Parameter	Model I.D.	Units	Model Scenario					
			Pb-1	Cu-1	Sb-I	Zn-1	Ag-1	Cd-1
Seepage velocity in downward direction	Vsz	ft/day	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016
Saturated void fraction (water volume/volume of solid) in soil	E	unitless	0.2	0.2	0.2	0.2	0.2	0.2
Specific discharge (Darcy velocity) in the downward Direction	Vdz	ft/day	0.00032	0.00032	0.00032	0.00032	0.00032	0.00032
Horizontal area of impacted soil	Ap	ft^2	36,935	26,818	39,435	36,780	27,775	27,411
Volumetric flow rate of liquid transporting solute into the aquifer (unsaturated-saturated zone interface)	Qp	ft^3/day	11.82	8.58	12.62	11.77	8.89	8.77
Seepage velocity in aquifer	Vsa	ft/day	1.0	1.0	1.0	1.0	1.0	1.0
Porosity of aquifer (fraction)	Ea	unitless	0.2	0.2	0.2	0.2	0.2	0.2
Specific discharge (Darcy velocity) in the aquifer	Vda	ft/day	0.2	0.2	0.2	0.2	0.2	0.2
Thickness of aquifer	Ha	ft	3	3	3	3	3	3
Width of impacted soil perpendicular to flow direction in the aquifer	Wp	ft	240	240	110	260	170	240
Volumetric flow rate of aquifer	Qa	ft^3/day	144	144	66	156	102	144
Initial or background concentration of solute in the aquifer	Cs	mg/l	0.00085	0.0037	0.001	0.0029	0.0023	0.00031
Concentration of solute in the infiltration at the unsaturated-saturated zone interface calculated by VLEACH model	Cp	mg/l	3.6	3.41	0.00131	8.2	0.01000	0.25
Solute concentration in groundwater as calculated by the SUMMERS model	Cgw	mg/l	0.27	0.20	0.00105	0.58	0.00292	0.0146
	Cgw	ug/l	274	195	1.05	578	2.92	14.65

Table 5-15

Predicted Maximum Concentrations of Inorganics in Groundwater Beneath the Source Polygon for Base Scenarios at SEAD-16

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Parameter	Predicted Maximum Concentration using SUMMERS Model (ug/l)	Groundwater Standard (ug/l)	Source of Groundwater Standard	Predicted Time of Maximum Concentration (years)	Predicted Time when the Groundwater Standard will be Exceeded (years)
Lead	2,441	15	EPA MCL	785	205
Copper	2,862	200	NYS GA	175	85
Antimony	1.01	6	EPA MCL	No Significant Impact	NA
Arsenic	22	25	NYS GA	20	NA
Mercury	0.05	2	NYS GA	No Significant Impact	NA
Zinc	1,283	300	NYS GA	130	65
Cadmium	3.08	5	EPA MCL	55	NA

Notes:
NA = Not Applicable; the groundwater standard was not exceeded during the simulation.

associated with the speciation and thus, the solubility, of the metals), the modeling suggests that a future threat to groundwater may exist from leaching of lead, copper and zinc in surface soils at SEAD-16.

SEAD-17

The results of the SUMMERS modeling for SEAD-17 yields the concentrations of the six inorganics in the aquifer immediately below the source polygon, assuming instantaneous mixing (Table 5-16). As at SEAD-16, the concentrations calculated by SUMMERS are a worst-case impact for each of the six inorganics in the base scenario, which uses the best estimates for all input parameters.

The modeling results indicate that at various times in the future lead, zinc, and cadmium may exceed their respective groundwater standards in the aquifer (Table 5-16), although the exceedences were significantly of lower magnitude compared to those at SEAD-16. The model predicts that lead will reach a maximum concentration in the aquifer of 274 µg/l in approximately 785 years. This concentration exceeds the EPA guidance value of 15 µg/l for lead. Also, the model predicts that it will take approximately 340 years before the MCL for lead is exceeded. The maximum concentrations for zinc and cadmium are predicted to be 578 µg/l (in 120 years) and 14.65 µg/l (in 55 years), which are also above their respective standards of 300 µg/l and 5 µg/l. The concentrations of zinc and cadmium in the aquifer are predicted to exceed their respective groundwater standards in 50 years and 30 years.

The concentrations of the other metals (copper, antimony, and silver) were predicted to be below their respective groundwater standards.

In summary, the SUMMERS model results provide insight as to the inorganics that are likely to pose a future threat to groundwater at SEAD-17. And, considering that the leaching concentrations of the metals calculated by VLEACH are estimates (due to the uncertainty associated with the speciation and thus, the solubility, of the metals), the modeling suggests that a future threat to groundwater may exist from leaching of lead, zinc, and cadmium in surface soils at SEAD-17.

5.4.5.3 SUMMERS Model Sensitivity Analysis

A sensitivity analysis was performed to evaluate the impact of various input parameters on the concentrations of the inorganics in the groundwater beneath the source polygons at both SEAD-16 and SEAD-17. The parameters evaluated were vertical seepage rate, concentration of the inorganic in the infiltrating water, and horizontal seepage velocity, saturated void fraction, and effective porosity of the aquifer. These parameters were chosen because they are believed to have the greatest impact on calculated groundwater concentrations.

The sensitivity analysis was performed by using values for each parameter listed above that were 50 percent below the base value, or best estimate scenario. Also, the effect of doubling the base value was evaluated. These two scenarios are referred to as "low" and "high", respectively, on Table 5-17. Only one metal, lead, was used to demonstrate the sensitivity of the SUMMERS model.

The results of the sensitivity analysis indicate that concentrations of lead in groundwater as calculated by SUMMERS were proportionally sensitive to variations in the vertical seepage rate, concentration of the inorganic in the infiltrating water, and horizontal seepage velocity, saturated void fraction and effective porosity (Table 5-17).

Table 5-16

Predicted Maximum Concentrations of Inorganics in Groundwater Beneath the Source Polygon for Base Scenarios at SEAD-17

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Parameter	Predicted Maximum Concentration using SUMMERS Model (ug/l)	Groundwater Standard (ug/l)	Source of Standard	Predicted Time of Maximum Concentration (years)	Predicted Time when the Groundwater Standard will be Exceeded (years)
Lead	274	15	EPA MCL	785	340
Copper	195	200	NYS GA	170	NA
Antimony	1.05	6	EPA MCL	No Significant Impacts	NA
Zinc	578	300	NYS GA	120	50
Silver	2.92	50	NYS GA	780	NA
Cadmium	14.65	5	EPA MCL	55	30

Notes:
NA = Not Applicable; the groundwater standard was not exceeded during the simulation.

ble 5-17

Summers Model Input Parameters and Results for a Sensitivity Analysis Using Lead at SEAD-16

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Parameter	Model I.D.	Units	Model Scenarios										
			Pb-1(base)	Pb-Vsz (low)	Pb-Vsz (high)	Pb-Cp(low)	Pb-Cp(high)	Pb-Vsa(low)	Pb-Vsa(high)	Pb-E(low)	Pb-E(high)	Pb-Ea(low)	Pb-Ea(high)
Seepage velocity in downward direction	Vsz	ft/day	0.0016	0.0008	0 0032	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016
Saturated void fraction (water volume/volume of solid) in soil	E	unitless	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.4	0.2	0.2
Specific discharge (Darcy velocity) in the downward Direction	Vdz	ft/day	0.00032	0 00016	0.00064	0 00032	0.00032	0.00032	0.00032	0.00016	0.00064	0.00032	0.00032
Horizontal area of impacted soil	Ap	ft^2	25,550	25,550	25,550	25,550	25,550	25,550	25,550	25,550	25,550	25,550	25,550
Volumetric flow rate of liquid transporting solute into the aquifer (unsaturated-saturated zone interface)	Qp	ft^3/day	8.18	4.09	16.35	8.18	8.18	8.18	8.18	4.09	16.35	8.18	8.18
Seepage velocity in aquifer	Vsa	ft/day	0.93	0.93	0.93	0.93	0.93	0.46	1.86	0.93	0.93	0.93	0.93
Porosity of aquifer (fraction)	Ea	unitless	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.4
Specific discharge (Darcy velocity) in the aquifer	Vda	ft/day	0.186	0 186	0.186	0.186	0.186	0.092	0.372	0.186	0.186	0.093	0.372
Thickness of aquifer	Ha	ft	3	3	3	3	3	3	3	3	3	3	3
Width of impacted soil perpendicular to flow direction in the aquifer	Wp	ft	320	320	320	320	320	320	320	320	320	320	320
Volumetric flow rate of aquifer	Qa	ft^3/day	178.56	178 56	178.56	178.56	178.56	88.32	357.12	178.56	178.56	89.28	357.12
Initial or background concentration of solute in the aquifer	Cs	mg/l	0.00085	0.00085	0.00085	0.00085	0.00085	0.00085	0.00085	0.00085	0.00085	0.00085	0.00085
Concentration of solute in the infiltration at the unsaturated-saturated zone interface calculated by VLEACH model	Cp	mg/l	55.73	55.73	55.73	27.86	111.46	55.73	55.73	55.73	55.73	55.73	55.73
Solute concentration in groundwater as calculated by the SUMMERS model	Cgw	mg/l	2.44	1.25	4.68	1.22	4.88	4.72	1.25	1.25	4.68	4.68	1.25
	Cgw	ug/l	2,441	1,248	4,676	1,221	4,881	4,723	1,248	1,248	4,676	4,676	1,248

Note:
(low) = reduced base value by 50 percent
(high) = doubled base value

6.0 BASELINE RISK ASSESSMENT INTRODUCTION

This section of the SEAD-16 & 17 Remedial Investigation report will present the baseline human health and ecological risk assessments that were performed for the Abandoned Deactivation Furnace site (SEAD-16). The workplan for this risk assessment was included in the "Project Scoping Plan for the Remedial Investigation Feasibility Study at SEAD-16 and 17" submitted to USEPA Region II in July 1995. The exposure scenarios that are evaluated in the baseline human health risk assessment (BRA) are:

- exposure of a current site worker to on-site contaminants
- exposure of a future industrial worker to on-site contaminants
- exposure of a future construction worker to on-site contaminants
- exposure of a future adolescent trespasser to on-site contaminants
- exposure of a future worker and child at an on-site day care center to on-site contaminants

The ecological risk assessment performed for this site considers the exposure of all species currently know to frequent, or potentially frequent, SEAD-16. The ecological risk assessment also identifies the deer mouse as the ecological risk assessment endpoint, which is then used to evaluate the impacts to the local ecosystem that are caused by the current site conditions.

Included in the sections that follow are brief descriptions of the Abandoned Deactivation Furnace's operating history and site characteristics, as well as full discussions on the identification of potential chemicals of concern, the screening of on-site inorganic element concentrations in soils, and determining reasonable and conservative exposure concentrations. Following these discussions, the report presents first the exposure scenarios that were defined for the human health BRA, followed by the human health risk calculations that quantify the carcinogenic and non-carcinogenic risk for the various exposure scenarios. The report then presents the ecological risk assessment that was performed for SEAD-16, which includes discussions on quantifying ecological exposure, determining ecological toxicity reference values, and calculating and evaluating ecological quotients.

6.1 OVERVIEW

The primary mandate of the Superfund program is to protect both human health and the environment from current and potential threats posed by uncontrolled hazardous substance releases. As part of the Remedial Investigation, the Abandoned Deactivation Furnace (SEAD 16) was evaluated to assess potential risks to human health and the environment. The goal of this baseline risk assessment is to provide a framework for developing and presenting the necessary risk information to assist in remedial action decisions.

The objectives of the baseline risk assessment are: to help determine whether additional response actions are necessary at the site; to provide a basis for determining residual chemical levels that are adequately protective of human health and the environment; to provide a basis for comparing potential health impacts of various remedial alternatives; and to help support selection of the "No Action" remedial alternative, where appropriate. To meet these objectives, the *Risk Assessment Guidance for Superfund* (RAGS) (USEPA, 1989a) was followed when possible and applicable. However, as stated in the guidance document, "The Human Health Evaluation Manual (also referred to as RAGS) admittedly cannot address all site circumstances." Technical judgment, consultation with USEPA staff, and recent publications were therefore also used in the development of the baseline risk assessment.

The baseline risk assessment is divided into two basic components: the human health evaluation and the ecological risk assessment evaluation. As part of the human health BRA, separate risk calculations are presented for current and future onsite land-use scenarios. The ecological risk assessment presents risk calculations for current site conditions only.

6.1.1 Site Description

SEDA is an active military facility located near Romulus, New York. The facility is located in an uplands area, at an elevation of approximately 600 feet above Mean Sea Level (MSL), that forms a divide separating two of the New York Finger Lakes, Cayuga Lake on the east and Seneca Lake on the west. Sparsely populated farmland covers most of the surrounding area. New York State Highways 96 and 96A adjoin SEDA on its east and west boundaries, respectively.

The Abandoned Deactivation Furnace (SEAD-16) is located in the east central portion of SEDA. The site consists of Building S311 and Building 366 and their surrounding grounds. The boundary of the site is delineated by a security fence, which is kept closed and locked year-round.

The site itself includes several vegetated areas to the east of Buildings S311 and 366, and a paved storage pad area to the west of Building S311. The Introduction (Section 1) and the Detailed Site Description (Section 3.1) portions of this report provide complete details on the site description.

6.1.2 General Site History

SEDA was constructed in 1941 and has been owned by the United States Government and operated by the Army since this time. Since its inception, SEDA's primary mission has been the receipt, storage, maintenance, and supply of military items. Prior to construction of the depot, the site was used for farming.

The Abandoned Deactivation Furnace (SEAD 16) was in use from approximately 1945 to the late 1960s. The Site History section of this report (Section 1.3.2) presents further information on this site's operating history.

6.1.3 General Sampling Locations and Media

During the RI and previous investigations, samples of air, soil, groundwater, surface water and sediment were collected. Air samples were collected from two locations within Building S311 as well as a single upwind (for comparison purposes only) location outside of Building S311. Soil samples were collected from random surface soil locations, biased surface soil locations where contaminants were likely to accumulate, and soil borings. Groundwater samples were collected from groundwater monitoring wells situated around Buildings S311 and 366. Surface water and sediment samples were collected from the drainage swales that run north and south of the SEAD-16 site. Complete details of all sampling locations are provided in the Study Area Investigation portion of this report (Section 2).

Following the collection, validation and screening (of metals in soil data and metals in groundwater data only) of these data, subsets of this collected data were utilized to establish the Exposure Point Concentrations (EPCs) for the various exposure scenarios used in the risk assessments. The selection of the data to be used to determine EPC values was based upon consideration of the sample media and the location and the depth of the sample, and is consistent with the identified exposure scenarios.

EPCs were determined for the following exposure routes for this risk assessment:

1. Ingestion and dermal contact with surface water and sediments while wading in the associated drainage swales.
2. Incidental ingestion and dermal contact to on-site soils (both surface and subsurface soils).

3. Inhalation of particulate matter in ambient air.

4. Inhalation of particulate matter in indoor air.

5. Ingestion and dermal contact with dust and debris (solids) inside the Abandoned Deactivation Furnace building (Building S311).

6. Ingestion of groundwater.

All on-site surface water and sediment data collected from SEAD-16 were used to estimate the EPC for future land scenarios only. Current land use scenarios applicable to surface water and sediment were not considered plausible because it is unlikely that the current site worker would wade in the on-site drainage swales.

All on-site groundwater data collected from SEAD-16 were used to estimate the EPC for future land use scenario only. Groundwater is not currently used, as drinking water at all of SEDA is delivered by pressure pipe from an off-site water supply.

All on-site surface soil samples from the 0 to 0.5 foot range were used in estimating the EPC due to on-site dermal exposure and soil ingestion for the current site worker and the future trespasser and day care scenarios. All surface and subsurface soil samples were combined and used in estimating the EPC for soil ingestion and dermal exposure for the future construction worker scenarios. Each soil data set was again used as input to a model to estimate ambient air EPCs of compounds contained in airborne particles derived from soil.

The indoor air samples collected in Building S311 and the building solids samples collected from both Building S311 and Building 366 were used to calculate the ambient air EPC and the ingestion and dermal contact EPCs, respectively, for the future industrial worker scenario.

6.1.4 Methodology and Organization of Document

The methodology employed for this baseline risk assessment follows USEPA guidance. The relationships of the major steps involved are presented in flowchart form in Figure 6-1. This section contains seven major subsections, as follows:

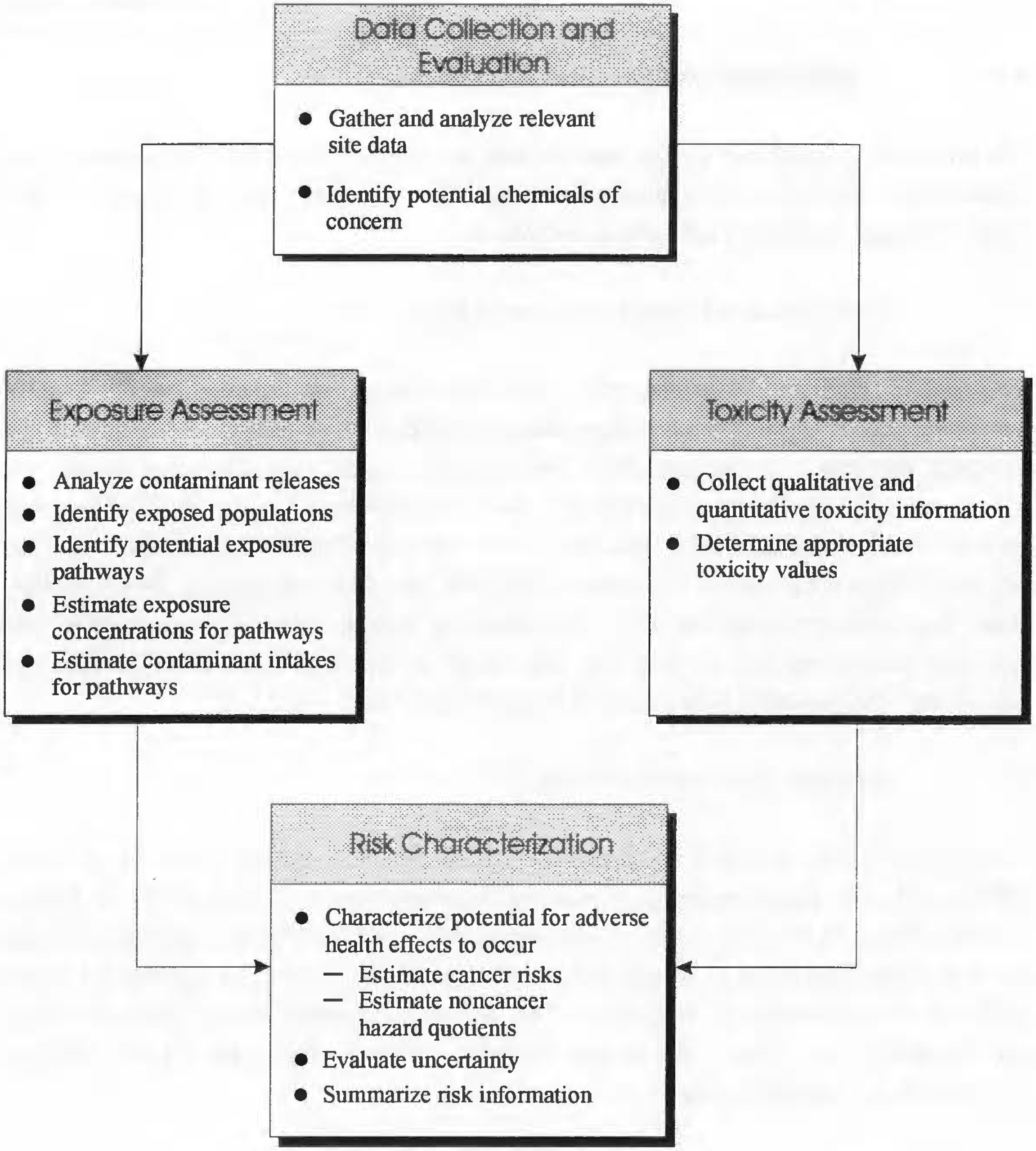
1. Identification of Chemicals of Concern (Section 6.2)

This section provides site-related data along with background chemical data. Detailed summaries and statistical analyses of these data are provided in this section. All chemicals with validated detections in the applicable environmental media were evaluated in the risk assessment. The relevant exposure pathway risks were calculated for each detected chemical. Also included in the Data Evaluation section is an evaluation of site background data. Relevant background data are presented and, where appropriate, statistical analyses (e.g. Wilcoxon Rank Sum Test) were performed to allow for comparing on-site chemical concentrations with available background data to drop any data which is not applicable to the baseline risk assessment. The process is further defined in more detail in section 6.2.2.

2. Exposure Assessment (Section 6.3)

This section includes derivation and presentation of the applicable exposure point concentrations (EPCs) used in the human health risk assessment. Exposure point concentrations for the baseline risk assessment are based on analytical data and modeling results. The EPCs provided are used for both current and future onsite land-use scenarios, and correspond to the applicable exposure pathways for the baseline risk assessment. The calculated risk values for all exposure scenarios are presented in two forms: Reasonable Maximum Exposure (RME) and Central Tendency (CT), based on Superfund guidance.

For the current land-use scenario, the only potentially exposed site receptors are site workers. For the future on-site land-use scenarios, industrial workers, construction workers, a child trespasser, and adult workers and children at an on-site day car center are the relevant exposed populations. In all scenarios, the calculated risk values apply to a hypothetical RME and CT individual working on or visiting the site, and the risk values are dictated by the collected environmental sampling data used in the risk assessment as exposure point concentrations for the applicable media.



Source: USEPA, 1989a

PARSONS
PARSONS ENGINEERING SCIENCE, INC.

CLIENT/PROJECT TITLE
SENECA ARMY DEPOT ACTIVITY
FORMER DEACTIVATION FURNACE
SEAD 16

DEPT ENVIRONMENTAL ENGINEERING
DWG NO. 729895-01001

FIGURE 6-1

BASELINE RISK ASSESSMENT PROCESS

SCALE Not Applicable
DATE JANUARY 1997

The three primary exposure routes considered in the baseline risk assessment are ingestion, inhalation, and dermal contact. Chemical intake values for both current and future land use are calculated based on exposure pathways, specific exposure values, and assumptions made for the RME and CT. Equations used to calculate intakes for all applicable exposure pathways are presented in this section. Detailed exposure/risk calculation spreadsheets are included in Appendix I.

3. Toxicity Assessment (Section 6.4)

This section presents oral, inhalation, and dermal toxicity values used in the human health risk calculations. Appropriate data sources (i.e. IRIS, HEAST and EPA Risk Assessment Issue papers) are provided to support the toxicity values.

4. Risk Characterization (Section 6.5)

This section presents the risk calculations for all human health exposure pathways for current and future land use. Non-carcinogenic and carcinogenic risk estimates are summarized for each receptor and exposure pathway. Detailed Hazard Quotients and Carcinogenic Risk calculations are included in Appendix I.

5. Ecological Risk Assessment (Section 6.6)

This section provides an identification and characterization of potential risks posed to environmental receptors. Included is an assessment of the ecological communities and dominant flora and fauna in the vicinity of SEAD 16, and an identification of potential pathways for receptor exposure.

6. Uncertainty (Section 6.7)

This section discusses the potential uncertainties of the methodology, assumptions, judgments, and data used in the risk assessment.

7. Summary (Section 6.8)

In this, the final section, all conclusions and results are summarized for the human health and ecological risk assessments.

6.2 IDENTIFICATION OF CHEMICALS OF CONCERN

The usability of site-related chemical data is a critical factor in assessing the human health effects of chemical contamination. The usability of these data depends on their availability, defensibility, and quality. Data availability depends on sampling history, while data defensibility depends on documentation, analytical methods, detection and reporting limits, and data validation. Data quality is measured via precision, accuracy, representativeness, completeness, and comparability.

Site-related chemical data must be managed and manipulated in order to determine representative concentrations of contaminants. Elements of data manipulation include combining multiple analyses of individual samples, incorporating results from the analyses of blind field duplicates, and addressing non-detected analytes in computing pertinent statistics. This section discusses these issues along with summarizing detected chemicals in environmental media and background.

Data collected during the RI were evaluated for suitability of use in the risk assessment as discussed in RAGS (EPA, 1989a). These decisions were based on analytical methods, quantitation limits, qualifiers, and blank contamination. The suitable RI data were then evaluated to determine relevant exposure point concentrations (EPCs) for all chemicals of potential concern, for which an exposure assessment, a toxicity assessment, and a risk characterization were performed.

6.2.1 General Site-specific Data Collection Considerations

6.2.1.1 Background Sampling

A total of 56 background soil samples and 28 background groundwater samples were compiled for this RI. Only inorganic constituents have been evaluated. Anthropogenic organic constituents have not been considered. This has produced a more conservative risk assessment since all organic constituents have been assumed to be present due to previous site activities. The results are discussed in Section 6.2.3 and have been presented for review in Table 6-2. Background soil and groundwater samples from the SEAD 25 RI, 25 ESIs, the Ash Landfill, and the OB Grounds site have been combined into the background database. This was done so that the statistical evaluation of the data would be representative of the variations in the site soil and groundwater. Geologically, the soil material is identical throughout SEDA, having been deposited from the same source. This fact justifies combining the background soil and groundwater chemical composition data from all SEDA background locations into one larger database.

The background groundwater data was also subject to a criterion of having turbidity levels that were below 50 NTUs. It was found that samples collected prior to implementing the USEPA's low-flow purging and pumping draft SOP, samples with high NTUs (greater than 50) had unrealistic concentrations of inorganic elements. The reported concentrations were often much higher than one could expect to be dissolved in groundwater, and it was concluded that the high reported concentrations were due to the high amount of suspended particulates in the groundwater samples. In addition, several locations were re-sampled using the draft EPA low flow purging and pumping protocols where high NTU groundwater samples had been collected in the past. The results from these locations showed that the concentrations of dissolved inorganic elements in the low NTU samples were greatly reduced when compared to the reported concentrations in those samples with high NTUs. This further reinforces the conclusion that the results from the high NTU samples were not representative of the true dissolved inorganic element concentrations in the background groundwater.

6.2.1.2 Sampling Locations and Media

Five media were sampled during the SEAD 16 RI: air, soil, groundwater, surface water, and sediment. Air samples were collected from three locations, surface soils were collected from 53 locations, subsurface soils were collected from five locations, groundwater samples were collected from 6 locations, and surface water and sediment samples were collected from 10 locations. The Study Area Investigation, SEAD-16 section of this report (Section 2.3) presents detailed descriptions of all media samples that have been collected from SEAD-16.

6.2.1.3 Sampling Methods

Detailed sampling methods are described in Section 2 , however a brief description of the sampling of the five media, surface water, sediment, soil, groundwater and air is provided below.

Indoor air sampling consisting of one 24-hour event was conducted at the Abandoned Deactivation Furnace Building (Building S-311) over a two day period. The sampling devices were field calibrated and the actual sample collection initiated on the first day. After a 24-hour sampling period ending on the second day, all samples were collected and prepared for shipment to the analytical laboratory for off-site chemical analysis. Separate samples were collected for the analysis of asbestos, metals (excluding mercury), mercury (Hg), and semivolatile organic compounds.

Surface water samples were collected from several locations on the site by directly filling the appropriate sample containers, or when the water depth was relatively shallow, sample containers were filled by bailing water into sample containers with a decontaminated glass beaker. Sediment samples were collected by scooping sediment into a decontaminated stainless steel bowl with a decontaminated trowel. Volatile organic analyte (VOA) samples were taken first, prior to any mixing of the sediments. Then, the bowl was refilled with additional sediment, if required, thoroughly mixed and the appropriate sample containers filled with sediment.

Soil borings were performed using a drilling rig equipped with 4.25-inch hollow stem augers. All borings were advanced to refusal on competent bedrock. During drilling, soil samples were collected continuously at 2-foot intervals using a decontaminated 2 or 1.5 foot split spoon sampler according to the method described in ASTM-D 1586-84. Three soil samples were collected for level IV analysis from each boring. Samples were collected from the surface (0 to 0.5 feet), at an intermediate zone (between 0.5 and 4 feet), and from the top of the water table, except where geologic or water table conditions prevented the collection of these samples.

During the RI groundwater sampling program, groundwater monitoring wells were sampled according to the Draft EPA SOP titled Groundwater Sampling Procedure, Low Flow Pump Purging and Sampling (EPA, May 15, 1995).

6.2.1.4 QA/QC Methods

QA/QC samples were analyzed for the purpose of assessing the quality of the sampling effort and the analytical data. The QA/QC samples included splits, field duplicates, field equipment blanks, trip blanks, and matrix spike/matrix spike duplicates. Split samples were analyzed by an EPA contract laboratory and the Corps of Engineers Missouri River Division (MRD) to assess the quality of the analytical data. One replicate sample was collected per batch of 20 or fewer samples per matrix. A field equipment blank was collected at a rate of one per field equipment decontaminated event to detect possible sources of contamination introduced from field sampling equipment or from carry over from one sample to the next. One trip blank was collected per day of water sampling for VOCs and was analyzed for VOCs to determine if samples were contaminated during transit or sample collection. For each group of 20 or less samples per matrix, additional sample volume was collected (for water samples) or an individual sample was selected and was used for matrix spike and matrix spike duplicate analyses. The use of matrix spikes gives insight to the analytical proficiency and efficiency of the analytical methods and indicates if the sample matrix may be attenuating or augmenting the reported analytical results.

6.2.1.5 Analytical Methods

NYSDEC CLP statement of work methods were used for the analysis of organic and inorganic constituents in soil, sediment, groundwater, and surface water. Herbicides, explosives, and nitrates were analyzed using EPA Methods 8150, 8330, and 353.2, respectively. Semivolatile organic compounds, metals, mercury, and asbestos in the air samples were analyzed using TO-13, NYSDEC CLP, NIOSH 6009, and NIOSH 7400 methods, respectively.

6.2.2 Data Usability

The data usability criteria for documentation, analytical methods, data validation, precision, accuracy, representativeness, comparability, and completeness are discussed in this section.

The RI data was collected during two investigations, the SEAD 16 and 17 ESI and the SEAD 16 and 17 Phase I RI. The ESI began in November 1993, and ended in February 1994. The Phase I RI began in August 1996 and ended in September 1996.

The data used for the risk assessment were grouped into eight databases, one for each of the exposure route/exposure scenarios that were developed from the exposure point pathway models. Each database contains data that is specific for one of the following types of media: surface soils (defined as soil samples collected from 0 to 6 inches below grade), surface and subsurface soils (i.e. all soils data), surface and subsurface soils to a depth of four feet (for the burrowing animal pathway of the ecological risk assessment), groundwater, surface water, sediments, air, and building solids.

The following sections describe the processes by which the data were analyzed, examined, and reduced to arrive at a list of analytes, for each exposure pathway, that were quantified for use in the baseline human health and ecological risk assessments.

6.2.2.1 Documentation

Documentation of sample collection and laboratory analysis is essential in order to authenticate conclusions derived from data. Standard operating procedures (SOPs) for field collection of samples are in Appendix A of the Project Workplan, and were followed during sample collection. Formal chain-of-custody records that included sample IDs, date sampled, sample collector, analyses and methods required, matrix, preservation per analysis, and comments were maintained.

Laboratory SOPs were used for all analyses required. Deviations from these SOPs were documented in case narratives that were part of each sample delivery group (SDG). Deviations from these SOPs were minor and did not adversely affect data quality.

6.2.2.2 Evaluation of Analytical Methods

All data used in the risk assessment were generated using level IV CLP protocols. Although level I field screening data were collected as part of the RI, it was not used in the quantitative risk assessment. Since the RI/FS ultimately requires decisions regarding future site remedial actions, the data collected must be of sufficient quantity to support this decision making process. The CLP was developed to ensure that consistent QA/QC methods are used when evaluating Superfund site samples. However, this does not mean that all CLP data is automatically of sufficient quality and reliability for use in the quantitative risk assessment.

The data used in this baseline risk assessment was validated in compliance with EPA Region II validation guidelines. The following criteria were considered and used to validate the data: spike/matrix spike duplicates, field duplicates, internal standard performance, compound identification, compound quantitation, spike sample recovery for metals, laboratory duplicates for metals, interference for metals, and qualifiers. Several steps were taken to ensure that the data was appropriate and reliable for use in the risk assessment. These steps, such as evaluation of quantitation limits, are discussed in the following sections.

6.2.2.3 Evaluation of Quantitation Limits and Data Reduction

Five points were considered when evaluating methods and reducing data based on sample quantitation limits (SQLs). These were 1) SQLs and their relation to reference concentrations, 2) unusually high SQLs, 3) when only some samples in a medium test positive for a chemical, 4) when SQLs are not available, and 5) when chemicals are not detected in any sample in a medium. Each of these points is discussed below.

SQLs and their relation to reference concentrations

To ensure that volatile organic analyses of groundwater could be compared to reference standards, the Phase II samples were analyzed using Method 524.2 with a level IV data package (to attain the lower sample quantitation limits) when the Phase I results had a majority of volatile organic compounds that were not detected using the NYSDEC CLP analysis.

Unusually high SQLs

The data in each of the databases for SEAD 16 were evaluated to determine if there were any unusually high SQLs. The mean and the standard deviation of the normal data were calculated for each analyte in each of the databases. The 95th percentile upper confidence limit (95% UCL) of the mean of the normal data was then calculated as follows:

$$95\%\, UCL = \overline{X} + t\left(s / n^{0.5}\right)$$

where:

$\overline{X}$ = the mean concentration
s = the standard deviation of the sample results
n = the number of samples
t = Student-t statistic for a one tailed t-test at the 95th confidence level

The 95% UCL is the value for which there is 95 percent confidence that the actual site mean does not exceed this value.

Unusually high SQLs that caused the 95% UCL of the normal data to exceed the actual maximum detected value were eliminated in accordance with RAGS (Section 5.3.2) guidance. The 95% UCL was then recalculated and the comparison repeated until either no unusually high SQLs caused the 95% UCL to exceed the maximum detected value or all unusually high SQLs had been eliminated.

Only some samples in a medium test positive for a chemical

Sometimes only some samples in a medium tested positively for a chemical. In the other samples the chemical was not measured above the quantitation limit, but it could of course be present just below the quantitation limit or it may not be there at all. To account for these possibilities, non-detected results were included in the risk assessment at one-half the SQL.

SQLs not available

SQLs were provided by the laboratory for every analyte that was not detected so no adjustment had to be made for non-detects without SQLs.

Chemicals are not detected in any sample in a medium

If for a given analyte in a medium, the validated results were all non-detects or rejected (qualifier = U, UJ, UR, JR or R), that analyte was eliminated from the risk assessment for that particular medium.

6.2.2.4 Evaluation of Qualified and Coded Data

Qualifiers are attached to data by laboratories conducting analyses and by data validation personnel. These qualifiers often pertain to QA/QC problems and may indicate questions concerning chemical identity, chemical concentration, or both. The qualifiers used are as follows:

U	The analyte was not detected.
UJ	The analyte was not detected; however, the associated reporting limit is approximate.
J	The analyte was positively identified; however, QC results indicate that the reported concentration may not be accurate and is therefore an estimate.
R, JR, UR	The analyte was rejected due to laboratory QC deficiencies, sample preservation problems, or holding time exceedance. The presence or absence of the analyte cannot be determined.

Before data was used in the quantitative risk assessment all qualifiers were addressed. This was done according to the prescribed data validation procedures. The end result of the data validation was four possible situations: 1) the data was rejected by either laboratory or data validation personnel and considered unusable (R, JR, UR), 2) the compound was analyzed for but was not detected (U), 3) the data was an estimated value (J), or 4) the data was unqualified. Data that was not detected by the laboratory (U) and was assigned a J by the data validation personnel, is considered a non-detect for the risk assessment (UJ).

6.2.2.5 Chemicals in Blanks

Blanks are QC samples analyzed in the same manner as environmental samples, and provide a means of identifying possible contamination of environmental samples. Sources of contamination include the laboratory, the sampling environment, and the sampling equipment. To address contamination, three types of blanks were analyzed: method blanks, trip blanks, and equipment rinseates. Method blanks consisted of laboratory reagent water or pre-purified and extracted sand taken through the same analytical process as environmental samples. Trip blanks consisted of distilled water poured into a 40-milliliter glass vial and sealed with a Teflon septum for soil and water samples. The trip blanks accompanied sample bottles to the field during sample collection. Trip blanks were not opened during sample collection. Equipment rinseates consisted of deionized water poured into or pumped through sampling devices and then transferred to sample bottles. Field blanks for the air sampling program consisted of sampling media (filters of PUF cartridges) being transported to the site, being briefly installed on the sampling devices, and then being packaged and sent to the analytical laboratory for analysis.

According to the data validation guidelines, if the blank contained detectable levels of a common laboratory contaminant, then the sample results were considered positive results (unqualified hit) only if the concentration in the sample exceeded ten times the maximum amount detected in any blank. If the concentration in the sample was less than ten times the maximum amount detected in the blank, it was concluded that the chemical was not detected. Common laboratory contaminants are acetone, 2-butanone, methylene chloride, toluene, and phthalate esters. If the blank contained detectable levels of a chemical that is not a common laboratory contaminant, then the sample results were considered positive results (unqualified hit) only if the concentration in the sample exceeded five times the maximum amount detected in any blank. If the concentration in the sample was less than five times the maximum amount detected in the blank, it was concluded that the chemical was not detected. This procedure was performed as part of the data validation.

6.2.2.6 Precision

The term precision is used to describe the reproducibility of results. It can be defined as the agreement between the numerical values of two or more measurements resulting from the same process. In the case of chemical analyses, precision is determined through the analyses of duplicate environmental samples. Duplicate sample analyses include matrix spikes, blank spikes, blind field duplicates, and replicate instrumental analyses of individual environmental samples.

Matrix spikes involve the introduction of compounds or elements to samples of known concentrations. The assumption is that these introduced compounds will be recovered from environmental samples to the same degree as in matrix spikes. Blank spikes involve the introduction of compounds or elements to laboratory reagent water or pre-purified and extracted sand. Blank spikes eliminate the possibility of matrix interference's or contributions, thereby monitoring analytical performance from sample preparation to analysis. Blind field duplicates are samples labeled with a fictitious sample ID taken from an existing sampling location. They are collected simultaneously with a properly labeled sample and provide the most legitimate means of assessing precision.

Precision estimates were obtained using the relative percent difference (RPD) between duplicate analyses. Overall precision, as well as precision control limits, were estimated using a weighted combination of RPDs from spikes and duplicate analyses. Precision and RPD were acceptable.

6.2.2.7 Accuracy

Accuracy is the degree to which a measurement represents the true value of that parameter. Estimates of accuracy are more difficult to obtain than precision since accuracy requires knowledge of the quantity desired. In the case of chemical analyses, accuracy is determined through the introduction of compounds or elements to samples of known concentrations, or analytical spikes. The assumption is that compounds will be recovered from environmental samples to the same degree as in analytical spikes.

Two types of compounds were added to environmental samples for assessing accuracy: surrogate compounds and matrix spike compounds. Surrogates are compounds that closely approximate target analytes in structure, but are not target analytes. Surrogate compounds generally are added to samples in the preparation stages and monitor the effectiveness of the preparation process. Matrix spike compounds are target analytes that are added based upon expectations of matrix interference's, that impede analyte detection. Laboratory method blank samples were spiked with surrogate compounds, per analysis day, as an additional means of estimating accuracy. The accuracy of chemical analyses was estimated using the percent recovery (PR) of compounds or elements that were added to analytical spikes. Accuracy and PR were acceptable.

6.2.2.8 Representativeness

Representativeness expresses the extent to which sample data characterize the population or environmental media. Factors influencing representativeness include sample collection, selection of sampling locations representative of site conditions, and use of appropriate chemical methods for sample analyses. Chemical analysis methods are addressed in Section 6.2.2.2. Sampling from locations representative of site conditions was achieved through implementation of the approved field sampling plan. Blind field duplicates were collected and analyzed in order to assess the influence of sample collection on representativeness. Approximately 5 percent of field samples were collected in duplicate. Representativeness was estimated using the RPD between blind field duplicates and was acceptable.

6.2.2.9 Comparability

Comparability is a data characteristic that measures the ability to compare data from a laboratory with data from others. Comparability factors include the use of standard analytical methodologies, data reported in standard or consistent units, appropriate frequency of applicable QC analyses, and laboratory participation in appropriate performance evaluation studies. All data were reported in appropriate and acceptable units. The laboratory performing the CLP inorganic and organic analyses participated in the quarterly USEPA blind performance evaluation program and the MRD performance evaluation program. Their performance in this program was acceptable.

6.2.2.10 Completeness

Completeness measures the amount of usable data relative to the amount of samples collected and analyzed. The completeness goal in the project workplan was 90 percent. Completeness was acceptable.

6.2.2.11 Tentatively Identified Compounds

Tentatively identified compounds (TICs) are compounds not specified on the Target Analyte List for quantification but were identified in the sample. TICs were grouped into two major classes: identified compounds and unknown compounds. Chromatographic peaks determined by the laboratory to be a unique compound were identified and quantified. Chromatographic peaks were identified through mass spectral library searches during sample analyses. Chromatographic peaks that failed absolute identification through mass spectral library searches were categorized into general classes by the laboratory. Although a significant number of TICs were detected in the soil samples, they are predominantly unknown alkanes, unknown aliphatic compounds and unknown PAHs, and are not included in the quantitative risk assessment, but are generally discussed in Section 6.5.1.3.

6.2.3 Site-specific Data Evaluation Considerations

Two major criteria were used to evaluate and select analytes that would be used in the quantitative risk assessment. The first criteria was applied to all of the analytes that were analyzed for in each database and consisted of selecting only those analytes that were detected in one or more of the environmental samples. The second criteria was applied only to the inorganic analyte data and consisted of determining if any analytes were present in the SEAD 16 sample populations at concentrations that tended to be above those found in background sample populations. The following paragraphs describe the various steps that were used to implement these criteria.

The first step in evaluating the data from SEAD 16 was to create the eight media-specific databases. Each database was examined separately in the site-specific data evaluations.

The data used in the databases (and the quantitative risk assessments) was validated as described previously. The data in each database was then reviewed and all compounds that were not detected in any sample in a particular database were deleted from that database, consistent with RAGs guidance. Table 6-1 summarizes the list of chemicals that were deleted from each of the databases for SEAD 16.

An intermediate step, which did not reduce the list of analytes any further but did eliminate data that would have "caused the calculated exposure concentration to exceed the maximum detected concentration" (EPA, 1989a), is the procedure by which samples were eliminated due to unusually high quantitation limits. This procedure is discussed in Section 6.2.2.3.

At this stage all qualifiers were no longer considered in the data analyses. For all subsequent operations that involved the use of data from the databases, all results with either no qualifier or a J qualifier were taken at full value and all non-detect (U or UJ qualifier) results were taken at half of the value.

A statistical analysis was then performed on the inorganic analytes in the soils, solids, and groundwater databases to determine whether or not the site population of a particular analyte and the background population for that same analyte were drawn from the same mean. Site populations in a particular database that were shown to be drawn from the same mean as the background population were considered to be indistinguishable from background and were

Table 6-1
SEAD-16 RI
Analytes Not Detected in Any Sample

Chemical Class	Analyte Name	Media
HERBICIDES	2,4,5-T	GROUNDWATER
HERBICIDES	2,4,5-TP/Silvex	GROUNDWATER
HERBICIDES	2,4-D	GROUNDWATER
HERBICIDES	2,4-DB	GROUNDWATER
HERBICIDES	Dalapon	GROUNDWATER
HERBICIDES	Dicamba	GROUNDWATER
HERBICIDES	Dichloroprop	GROUNDWATER
HERBICIDES	Dinoseb	GROUNDWATER
HERBICIDES	MCPA	GROUNDWATER
HERBICIDES	MCPP	GROUNDWATER
SEMIVOLATILE ORGANICS	2,2'-oxybis(1-Chloropropane)	GROUNDWATER
METALS	Cyanide	SEDIMENT
PESTICIDES/PCB	Aldrin	SEDIMENT
PESTICIDES/PCB	Alpha-BHC	SEDIMENT
PESTICIDES/PCB	Aroclor-1016	SEDIMENT
PESTICIDES/PCB	Aroclor-1221	SEDIMENT
PESTICIDES/PCB	Aroclor-1232	SEDIMENT
PESTICIDES/PCB	Aroclor-1242	SEDIMENT
PESTICIDES/PCB	Aroclor-1248	SEDIMENT
PESTICIDES/PCB	Beta-BHC	SEDIMENT
PESTICIDES/PCB	Delta-BHC	SEDIMENT
PESTICIDES/PCB	Dieldrin	SEDIMENT
PESTICIDES/PCB	Endrin	SEDIMENT
PESTICIDES/PCB	Endrin ketone	SEDIMENT
PESTICIDES/PCB	Gamma-BHC/Lindane	SEDIMENT
PESTICIDES/PCB	Heptachlor	SEDIMENT
PESTICIDES/PCB	Methoxychlor	SEDIMENT
PESTICIDES/PCB	Toxaphene	SEDIMENT
SEMIVOLATILE ORGANICS	1,2,4-Trichlorobenzene	SEDIMENT
SEMIVOLATILE ORGANICS	1,2-Dichlorobenzene	SEDIMENT
SEMIVOLATILE ORGANICS	1,3,5-Trinitrobenzene	SEDIMENT
SEMIVOLATILE ORGANICS	1,3-Dichlorobenzene	SEDIMENT
SEMIVOLATILE ORGANICS	1,3-Dinitrobenzene	SEDIMENT
SEMIVOLATILE ORGANICS	1,4-Dichlorobenzene	SEDIMENT
SEMIVOLATILE ORGANICS	2,4,5-Trichlorophenol	SEDIMENT
SEMIVOLATILE ORGANICS	2,4,6-Trichlorophenol	SEDIMENT
SEMIVOLATILE ORGANICS	2,4,6-Trinitrotoluene	SEDIMENT
SEMIVOLATILE ORGANICS	2,4-Dichlorophenol	SEDIMENT
SEMIVOLATILE ORGANICS	2,4-Dimethylphenol	SEDIMENT
SEMIVOLATILE ORGANICS	2,4-Dinitrophenol	SEDIMENT
SEMIVOLATILE ORGANICS	2,6-Dinitrotoluene	SEDIMENT
SEMIVOLATILE ORGANICS	2-Chloronaphthalene	SEDIMENT
SEMIVOLATILE ORGANICS	2-Chlorophenol	SEDIMENT
SEMIVOLATILE ORGANICS	2-Methylphenol	SEDIMENT
SEMIVOLATILE ORGANICS	2-Nitroaniline	SEDIMENT
SEMIVOLATILE ORGANICS	2-Nitrophenol	SEDIMENT
SEMIVOLATILE ORGANICS	2-Nitrotoluene	SEDIMENT
SEMIVOLATILE ORGANICS	2-amino-4,6-Dinitrotoluene	SEDIMENT

Table 6-1
SEAD-16 RI
Analytes Not Detected in Any Sample

Chemical Class	Analyte Name	Media
SEMIVOLATILE ORGANICS	3,3`-Dichlorobenzidine	SEDIMENT
SEMIVOLATILE ORGANICS	3-Nitroaniline	SEDIMENT
SEMIVOLATILE ORGANICS	3-Nitrotoluene	SEDIMENT
SEMIVOLATILE ORGANICS	4,6-Dinitro-2-methylphenol	SEDIMENT
SEMIVOLATILE ORGANICS	4-Bromophenyl phenyl ether	SEDIMENT
SEMIVOLATILE ORGANICS	4-Chloro-3-methylphenol	SEDIMENT
SEMIVOLATILE ORGANICS	4-Chloroaniline	SEDIMENT
SEMIVOLATILE ORGANICS	4-Chlorophenyl phenyl ether	SEDIMENT
SEMIVOLATILE ORGANICS	4-Methylphenol	SEDIMENT
SEMIVOLATILE ORGANICS	4-Nitroaniline	SEDIMENT
SEMIVOLATILE ORGANICS	4-Nitrophenol	SEDIMENT
SEMIVOLATILE ORGANICS	4-Nitrotoluene	SEDIMENT
SEMIVOLATILE ORGANICS	4-amino-2,6-Dinitrotoluene	SEDIMENT
SEMIVOLATILE ORGANICS	Bis(2-Chloroethoxy)methane	SEDIMENT
SEMIVOLATILE ORGANICS	Bis(2-Chloroethyl)ether	SEDIMENT
SEMIVOLATILE ORGANICS	Bis(2-Chloroisopropyl)ether	SEDIMENT
SEMIVOLATILE ORGANICS	Butylbenzylphthalate	SEDIMENT
SEMIVOLATILE ORGANICS	Di-n-octylphthalate	SEDIMENT
SEMIVOLATILE ORGANICS	Dibenzofuran	SEDIMENT
SEMIVOLATILE ORGANICS	Diethyl phthalate	SEDIMENT
SEMIVOLATILE ORGANICS	Dimethylphthalate	SEDIMENT
SEMIVOLATILE ORGANICS	Fluorene	SEDIMENT
SEMIVOLATILE ORGANICS	HMX	SEDIMENT
SEMIVOLATILE ORGANICS	Hexachlorobenzene	SEDIMENT
SEMIVOLATILE ORGANICS	Hexachlorobutadiene	SEDIMENT
SEMIVOLATILE ORGANICS	Hexachlorocyclopentadiene	SEDIMENT
SEMIVOLATILE ORGANICS	Hexachloroethane	SEDIMENT
SEMIVOLATILE ORGANICS	Isophorone	SEDIMENT
SEMIVOLATILE ORGANICS	N-Nitrosodipropylamine	SEDIMENT
SEMIVOLATILE ORGANICS	Naphthalene	SEDIMENT
SEMIVOLATILE ORGANICS	Nitrobenzene	SEDIMENT
SEMIVOLATILE ORGANICS	Pentachlorophenol	SEDIMENT
SEMIVOLATILE ORGANICS	Phenol	SEDIMENT
SEMIVOLATILE ORGANICS	RDX	SEDIMENT
SEMIVOLATILE ORGANICS	Tetryl	SEDIMENT
VOLATILE ORGANICS	1,1,1-Trichloroethane	SEDIMENT
VOLATILE ORGANICS	1,1,2,2-Tetrachloroethane	SEDIMENT
VOLATILE ORGANICS	1,1,2-Trichloroethane	SEDIMENT
VOLATILE ORGANICS	1,1-Dichloroethane	SEDIMENT
VOLATILE ORGANICS	1,1-Dichloroethene	SEDIMENT
VOLATILE ORGANICS	1,2-Dichlorobenzene	SEDIMENT
VOLATILE ORGANICS	1,2-Dichloroethane	SEDIMENT
VOLATILE ORGANICS	1,2-Dichloroethene (total)	SEDIMENT
VOLATILE ORGANICS	1,2-Dichloropropane	SEDIMENT
VOLATILE ORGANICS	1,3-Dichlorobenzene	SEDIMENT
VOLATILE ORGANICS	1,4-Dichlorobenzene	SEDIMENT
VOLATILE ORGANICS	Benzene	SEDIMENT
VOLATILE ORGANICS	Bromodichloromethane	SEDIMENT

Table 6-1
SEAD-16 RI
Analytes Not Detected in Any Sample

Chemical Class	Analyte Name	Media
VOLATILE ORGANICS	Bromoform	SEDIMENT
VOLATILE ORGANICS	Carbon disulfide	SEDIMENT
VOLATILE ORGANICS	Carbon tetrachloride	SEDIMENT
VOLATILE ORGANICS	Chlorobenzene	SEDIMENT
VOLATILE ORGANICS	Chlorodibromomethane	SEDIMENT
VOLATILE ORGANICS	Chloroethane	SEDIMENT
VOLATILE ORGANICS	Chloroform	SEDIMENT
VOLATILE ORGANICS	Cis-1,3-Dichloropropene	SEDIMENT
VOLATILE ORGANICS	Ethyl benzene	SEDIMENT
VOLATILE ORGANICS	Methyl bromide	SEDIMENT
VOLATILE ORGANICS	Methyl butyl ketone	SEDIMENT
VOLATILE ORGANICS	Methyl chloride	SEDIMENT
VOLATILE ORGANICS	Methyl isobutyl ketone	SEDIMENT
VOLATILE ORGANICS	Methylene chloride	SEDIMENT
VOLATILE ORGANICS	Styrene	SEDIMENT
VOLATILE ORGANICS	Tetrachloroethene	SEDIMENT
VOLATILE ORGANICS	Toluene	SEDIMENT
VOLATILE ORGANICS	Total Xylenes	SEDIMENT
VOLATILE ORGANICS	Trans-1,3-Dichloropropene	SEDIMENT
VOLATILE ORGANICS	Trichloroethene	SEDIMENT
VOLATILE ORGANICS	Vinyl chloride	SEDIMENT
HERBICIDES	2,4,5-TP/Silvex	SOIL
HERBICIDES	2,4-D	SOIL
HERBICIDES	2,4-DB	SOIL
HERBICIDES	Dalapon	SOIL
HERBICIDES	Dicamba	SOIL
HERBICIDES	Dichloroprop	SOIL
HERBICIDES	Dinoseb	SOIL
HERBICIDES	MCPA	SOIL
PESTICIDES/PCB	Alpha-BHC	SOIL
PESTICIDES/PCB	Aroclor-1016	SOIL
PESTICIDES/PCB	Aroclor-1221	SOIL
PESTICIDES/PCB	Aroclor-1232	SOIL
PESTICIDES/PCB	Aroclor-1242	SOIL
PESTICIDES/PCB	Aroclor-1248	SOIL
PESTICIDES/PCB	Methoxychlor	SOIL
SEMIVOLATILE ORGANICS	1,2,4-Trichlorobenzene	SOIL
SEMIVOLATILE ORGANICS	1,2-Dichlorobenzene	SOIL
SEMIVOLATILE ORGANICS	1,3,5-Trinitrobenzene	SOIL
SEMIVOLATILE ORGANICS	1,3-Dichlorobenzene	SOIL
SEMIVOLATILE ORGANICS	1,3-Dinitrobenzene	SOIL
SEMIVOLATILE ORGANICS	1,4-Dichlorobenzene	SOIL
SEMIVOLATILE ORGANICS	2,2'-oxybis(1-Chloropropane)	SOIL
SEMIVOLATILE ORGANICS	2,4,5-Trichlorophenol	SOIL
SEMIVOLATILE ORGANICS	2,4,6-Trichlorophenol	SOIL
SEMIVOLATILE ORGANICS	2,4,6-Trinitrotoluene	SOIL
SEMIVOLATILE ORGANICS	2,4-Dichlorophenol	SOIL
SEMIVOLATILE ORGANICS	2,4-Dimethylphenol	SOIL

Table 6-1
SEAD-16 RI
Analytes Not Detected in Any Sample

Chemical Class	Analyte Name	Media
SEMIVOLATILE ORGANICS	2,4-Dinitrophenol	SOIL
SEMIVOLATILE ORGANICS	2-Chloronaphthalene	SOIL
SEMIVOLATILE ORGANICS	2-Chlorophenol	SOIL
SEMIVOLATILE ORGANICS	2-Nitroaniline	SOIL
SEMIVOLATILE ORGANICS	2-Nitrophenol	SOIL
SEMIVOLATILE ORGANICS	4,6-Dinitro-2-methylphenol	SOIL
SEMIVOLATILE ORGANICS	4-Bromophenyl phenyl ether	SOIL
SEMIVOLATILE ORGANICS	4-Chloro-3-methylphenol	SOIL
SEMIVOLATILE ORGANICS	4-Chloroaniline	SOIL
SEMIVOLATILE ORGANICS	4-Chlorophenyl phenyl ether	SOIL
SEMIVOLATILE ORGANICS	4-Methylphenol	SOIL
SEMIVOLATILE ORGANICS	4-Nitroaniline	SOIL
SEMIVOLATILE ORGANICS	4-Nitrophenol	SOIL
SEMIVOLATILE ORGANICS	4-amino-2,6-Dinitrotoluene	SOIL
SEMIVOLATILE ORGANICS	Bis(2-Chloroethoxy)methane	SOIL
SEMIVOLATILE ORGANICS	Bis(2-Chloroethyl)ether	SOIL
SEMIVOLATILE ORGANICS	Bis(2-Chloroisopropyl)ether	SOIL
SEMIVOLATILE ORGANICS	Di-n-octylphthalate	SOIL
SEMIVOLATILE ORGANICS	Dimethylphthalate	SOIL
SEMIVOLATILE ORGANICS	HMX	SOIL
SEMIVOLATILE ORGANICS	Hexachlorobenzene	SOIL
SEMIVOLATILE ORGANICS	Hexachlorobutadiene	SOIL
SEMIVOLATILE ORGANICS	Hexachlorocyclopentadiene	SOIL
SEMIVOLATILE ORGANICS	Hexachloroethane	SOIL
SEMIVOLATILE ORGANICS	Isophorone	SOIL
SEMIVOLATILE ORGANICS	N-Nitrosodipropylamine	SOIL
SEMIVOLATILE ORGANICS	Nitrobenzene	SOIL
SEMIVOLATILE ORGANICS	Phenol	SOIL
SEMIVOLATILE ORGANICS	RDX	SOIL
VOLATILE ORGANICS	1,1,1-Trichloroethane	SOIL
VOLATILE ORGANICS	1,1,2-Trichloroethane	SOIL
VOLATILE ORGANICS	1,1-Dichloroethane	SOIL
VOLATILE ORGANICS	1,1-Dichloroethene	SOIL
VOLATILE ORGANICS	1,2-Dichlorobenzene	SOIL
VOLATILE ORGANICS	1,2-Dichloroethane	SOIL
VOLATILE ORGANICS	1,2-Dichloroethene (total)	SOIL
VOLATILE ORGANICS	1,2-Dichloropropane	SOIL
VOLATILE ORGANICS	1,3-Dichlorobenzene	SOIL
VOLATILE ORGANICS	1,4-Dichlorobenzene	SOIL
VOLATILE ORGANICS	Bromodichloromethane	SOIL
VOLATILE ORGANICS	Bromoform	SOIL
VOLATILE ORGANICS	Carbon tetrachloride	SOIL
VOLATILE ORGANICS	Chlorobenzene	SOIL
VOLATILE ORGANICS	Chlorodibromomethane	SOIL
VOLATILE ORGANICS	Chloroethane	SOIL
VOLATILE ORGANICS	Cis-1,3-Dichloropropene	SOIL
VOLATILE ORGANICS	Ethyl benzene	SOIL
VOLATILE ORGANICS	Methyl bromide	SOIL

Table 6-1
SEAD-16 RI
Analytes Not Detected in Any Sample

Chemical Class	Analyte Name	Media
VOLATILE ORGANICS	Methyl butyl ketone	SOIL
VOLATILE ORGANICS	Methyl chloride	SOIL
VOLATILE ORGANICS	Methyl isobutyl ketone	SOIL
VOLATILE ORGANICS	Styrene	SOIL
VOLATILE ORGANICS	Tetrachloroethene	SOIL
VOLATILE ORGANICS	Trans-1,3-Dichloropropene	SOIL
VOLATILE ORGANICS	Trichloroethene	SOIL
VOLATILE ORGANICS	Vinyl chloride	SOIL
HERBICIDES	Dalapon	SOLIDS
HERBICIDES	Dicamba	SOLIDS
HERBICIDES	Dinoseb	SOLIDS
PESTICIDES/PCB	Aldrin	SOLIDS
PESTICIDES/PCB	Aroclor-1016	SOLIDS
PESTICIDES/PCB	Aroclor-1221	SOLIDS
PESTICIDES/PCB	Aroclor-1232	SOLIDS
PESTICIDES/PCB	Aroclor-1242	SOLIDS
PESTICIDES/PCB	Aroclor-1248	SOLIDS
PESTICIDES/PCB	Beta-BHC	SOLIDS
PESTICIDES/PCB	Delta-BHC	SOLIDS
PESTICIDES/PCB	Endosulfan sulfate	SOLIDS
PESTICIDES/PCB	Endrin aldehyde	SOLIDS
PESTICIDES/PCB	Endrin ketone	SOLIDS
PESTICIDES/PCB	Heptachlor	SOLIDS
PESTICIDES/PCB	Methoxychlor	SOLIDS
PESTICIDES/PCB	Toxaphene	SOLIDS
SEMIVOLATILE ORGANICS	1,2,4-Trichlorobenzene	SOLIDS
SEMIVOLATILE ORGANICS	1,2-Dichlorobenzene	SOLIDS
SEMIVOLATILE ORGANICS	1,3-Dichlorobenzene	SOLIDS
SEMIVOLATILE ORGANICS	1,3-Dinitrobenzene	SOLIDS
SEMIVOLATILE ORGANICS	1,4-Dichlorobenzene	SOLIDS
SEMIVOLATILE ORGANICS	2,2'-oxybis(1-Chloropropane)	SOLIDS
SEMIVOLATILE ORGANICS	2,4,5-Trichlorophenol	SOLIDS
SEMIVOLATILE ORGANICS	2,4,6-Trichlorophenol	SOLIDS
SEMIVOLATILE ORGANICS	2,4-Dichlorophenol	SOLIDS
SEMIVOLATILE ORGANICS	2,4-Dimethylphenol	SOLIDS
SEMIVOLATILE ORGANICS	2,4-Dinitrophenol	SOLIDS
SEMIVOLATILE ORGANICS	2-Chloronaphthalene	SOLIDS
SEMIVOLATILE ORGANICS	2-Chlorophenol	SOLIDS
SEMIVOLATILE ORGANICS	2-Methylphenol	SOLIDS
SEMIVOLATILE ORGANICS	2-Nitroaniline	SOLIDS
SEMIVOLATILE ORGANICS	2-Nitrophenol	SOLIDS
SEMIVOLATILE ORGANICS	2-amino-4,6-Dinitrotoluene	SOLIDS
SEMIVOLATILE ORGANICS	3,3'-Dichlorobenzidine	SOLIDS
SEMIVOLATILE ORGANICS	3-Nitroaniline	SOLIDS
SEMIVOLATILE ORGANICS	4,6-Dinitro-2-methylphenol	SOLIDS
SEMIVOLATILE ORGANICS	4-Bromophenyl phenyl ether	SOLIDS
SEMIVOLATILE ORGANICS	4-Chloro-3-methylphenol	SOLIDS
SEMIVOLATILE ORGANICS	4-Chloroaniline	SOLIDS

Table 6-1
SEAD-16 RI
Analytes Not Detected in Any Sample

Chemical Class	Analyte Name	Media
SEMIVOLATILE ORGANICS	4-Chlorophenyl phenyl ether	SOLIDS
SEMIVOLATILE ORGANICS	4-Methylphenol	SOLIDS
SEMIVOLATILE ORGANICS	4-Nitroaniline	SOLIDS
SEMIVOLATILE ORGANICS	4-Nitrophenol	SOLIDS
SEMIVOLATILE ORGANICS	4-amino-2,6-Dinitrotoluene	SOLIDS
SEMIVOLATILE ORGANICS	Acenaphthylene	SOLIDS
SEMIVOLATILE ORGANICS	Bis(2-Chloroethoxy)methane	SOLIDS
SEMIVOLATILE ORGANICS	Bis(2-Chloroethyl)ether	SOLIDS
SEMIVOLATILE ORGANICS	Bis(2-Chloroisopropyl)ether	SOLIDS
SEMIVOLATILE ORGANICS	Di-n-octylphthalate	SOLIDS
SEMIVOLATILE ORGANICS	Dimethylphthalate	SOLIDS
SEMIVOLATILE ORGANICS	HMX	SOLIDS
SEMIVOLATILE ORGANICS	Hexachlorobenzene	SOLIDS
SEMIVOLATILE ORGANICS	Hexachlorobutadiene	SOLIDS
SEMIVOLATILE ORGANICS	Hexachlorocyclopentadiene	SOLIDS
SEMIVOLATILE ORGANICS	Hexachloroethane	SOLIDS
SEMIVOLATILE ORGANICS	Isophorone	SOLIDS
SEMIVOLATILE ORGANICS	N-Nitrosodipropylamine	SOLIDS
SEMIVOLATILE ORGANICS	Nitrobenzene	SOLIDS
SEMIVOLATILE ORGANICS	RDX	SOLIDS
SEMIVOLATILE ORGANICS	Tetryl	SOLIDS
VOLATILE ORGANICS	1,1,2,2-Tetrachloroethane	SOLIDS
VOLATILE ORGANICS	1,1,2-Trichloroethane	SOLIDS
VOLATILE ORGANICS	1,1-Dichloroethane	SOLIDS
VOLATILE ORGANICS	1,1-Dichloroethene	SOLIDS
VOLATILE ORGANICS	1,2-Dichlorobenzene	SOLIDS
VOLATILE ORGANICS	1,2-Dichloroethane	SOLIDS
VOLATILE ORGANICS	1,2-Dichloroethene (total)	SOLIDS
VOLATILE ORGANICS	1,2-Dichloropropane	SOLIDS
VOLATILE ORGANICS	1,3-Dichlorobenzene	SOLIDS
VOLATILE ORGANICS	1,4-Dichlorobenzene	SOLIDS
VOLATILE ORGANICS	Acetone	SOLIDS
VOLATILE ORGANICS	Benzene	SOLIDS
VOLATILE ORGANICS	Bromodichloromethane	SOLIDS
VOLATILE ORGANICS	Bromoform	SOLIDS
VOLATILE ORGANICS	Carbon disulfide	SOLIDS
VOLATILE ORGANICS	Carbon tetrachloride	SOLIDS
VOLATILE ORGANICS	Chlorobenzene	SOLIDS
VOLATILE ORGANICS	Chlorodibromomethane	SOLIDS
VOLATILE ORGANICS	Chloroethane	SOLIDS
VOLATILE ORGANICS	Cis-1,3-Dichloropropene	SOLIDS
VOLATILE ORGANICS	Ethyl benzene	SOLIDS
VOLATILE ORGANICS	Methyl butyl ketone	SOLIDS
VOLATILE ORGANICS	Methyl ethyl ketone	SOLIDS
VOLATILE ORGANICS	Methyl isobutyl ketone	SOLIDS
VOLATILE ORGANICS	Styrene	SOLIDS
VOLATILE ORGANICS	Tetrachloroethene	SOLIDS
VOLATILE ORGANICS	Total Xylenes	SOLIDS

Table 6-1
SEAD-16 RI
Analytes Not Detected in Any Sample

Chemical Class	Analyte Name	Media
VOLATILE ORGANICS	Trans-1,3-Dichloropropene	SOLIDS
VOLATILE ORGANICS	Vinyl chloride	SOLIDS
HERBICIDES	2,4,5-T	SURFACE WATER
HERBICIDES	2,4,5-TP/Silvex	SURFACE WATER
HERBICIDES	2,4-D	SURFACE WATER
HERBICIDES	2,4-DB	SURFACE WATER
HERBICIDES	Dalapon	SURFACE WATER
HERBICIDES	Dicamba	SURFACE WATER
HERBICIDES	Dichloroprop	SURFACE WATER
HERBICIDES	Dinoseb	SURFACE WATER
HERBICIDES	MCPA	SURFACE WATER
HERBICIDES	MCPP	SURFACE WATER
METALS	Beryllium	SURFACE WATER
METALS	Cyanide	SURFACE WATER
METALS	Thallium	SURFACE WATER
PESTICIDES/PCB	4,4`-DDD	SURFACE WATER
PESTICIDES/PCB	4,4`-DDE	SURFACE WATER
PESTICIDES/PCB	4,4`-DDT	SURFACE WATER
PESTICIDES/PCB	Aldrin	SURFACE WATER
PESTICIDES/PCB	Alpha-BHC	SURFACE WATER
PESTICIDES/PCB	Alpha-Chlordane	SURFACE WATER
PESTICIDES/PCB	Aroclor-1016	SURFACE WATER
PESTICIDES/PCB	Aroclor-1221	SURFACE WATER
PESTICIDES/PCB	Aroclor-1232	SURFACE WATER
PESTICIDES/PCB	Aroclor-1242	SURFACE WATER
PESTICIDES/PCB	Aroclor-1248	SURFACE WATER
PESTICIDES/PCB	Aroclor-1254	SURFACE WATER
PESTICIDES/PCB	Aroclor-1260	SURFACE WATER
PESTICIDES/PCB	Beta-BHC	SURFACE WATER
PESTICIDES/PCB	Delta-BHC	SURFACE WATER
PESTICIDES/PCB	Dieldrin	SURFACE WATER
PESTICIDES/PCB	Endosulfan I	SURFACE WATER
PESTICIDES/PCB	Endosulfan II	SURFACE WATER
PESTICIDES/PCB	Endosulfan sulfate	SURFACE WATER
PESTICIDES/PCB	Endrin	SURFACE WATER
PESTICIDES/PCB	Endrin aldehyde	SURFACE WATER
PESTICIDES/PCB	Endrin ketone	SURFACE WATER
PESTICIDES/PCB	Gamma-BHC/Lindane	SURFACE WATER
PESTICIDES/PCB	Gamma-Chlordane	SURFACE WATER
PESTICIDES/PCB	Heptachlor	SURFACE WATER
PESTICIDES/PCB	Heptachlor epoxide	SURFACE WATER
PESTICIDES/PCB	Methoxychlor	SURFACE WATER
PESTICIDES/PCB	Toxaphene	SURFACE WATER
SEMIVOLATILE ORGANICS	1,2,4-Trichlorobenzene	SURFACE WATER
SEMIVOLATILE ORGANICS	1,2-Dichlorobenzene	SURFACE WATER
SEMIVOLATILE ORGANICS	1,3,5-Trinitrobenzene	SURFACE WATER
SEMIVOLATILE ORGANICS	1,3-Dichlorobenzene	SURFACE WATER
SEMIVOLATILE ORGANICS	1,3-Dinitrobenzene	SURFACE WATER

Table 6-1
SEAD-16 RI
Analytes Not Detected in Any Sample

Chemical Class	Analyte Name	Media
SEMIVOLATILE ORGANICS	1,4-Dichlorobenzene	SURFACE WATER
SEMIVOLATILE ORGANICS	2,2'-oxybis(1-Chloropropane)	SURFACE WATER
SEMIVOLATILE ORGANICS	2,4,5-Trichlorophenol	SURFACE WATER
SEMIVOLATILE ORGANICS	2,4,6-Trichlorophenol	SURFACE WATER
SEMIVOLATILE ORGANICS	2,4,6-Trinitrotoluene	SURFACE WATER
SEMIVOLATILE ORGANICS	2,4-Dichlorophenol	SURFACE WATER
SEMIVOLATILE ORGANICS	2,4-Dimethylphenol	SURFACE WATER
SEMIVOLATILE ORGANICS	2,4-Dinitrophenol	SURFACE WATER
SEMIVOLATILE ORGANICS	2,4-Dinitrotoluene	SURFACE WATER
SEMIVOLATILE ORGANICS	2,6-Dinitrotoluene	SURFACE WATER
SEMIVOLATILE ORGANICS	2-Chloronaphthalene	SURFACE WATER
SEMIVOLATILE ORGANICS	2-Chlorophenol	SURFACE WATER
SEMIVOLATILE ORGANICS	2-Methylnaphthalene	SURFACE WATER
SEMIVOLATILE ORGANICS	2-Methylphenol	SURFACE WATER
SEMIVOLATILE ORGANICS	2-Nitroaniline	SURFACE WATER
SEMIVOLATILE ORGANICS	2-Nitrophenol	SURFACE WATER
SEMIVOLATILE ORGANICS	2-Nitrotoluene	SURFACE WATER
SEMIVOLATILE ORGANICS	2-amino-4,6-Dinitrotoluene	SURFACE WATER
SEMIVOLATILE ORGANICS	3,3`-Dichlorobenzidine	SURFACE WATER
SEMIVOLATILE ORGANICS	3-Nitroaniline	SURFACE WATER
SEMIVOLATILE ORGANICS	3-Nitrotoluene	SURFACE WATER
SEMIVOLATILE ORGANICS	4,6-Dinitro-2-methylphenol	SURFACE WATER
SEMIVOLATILE ORGANICS	4-Bromophenyl phenyl ether	SURFACE WATER
SEMIVOLATILE ORGANICS	4-Chloro-3-methylphenol	SURFACE WATER
SEMIVOLATILE ORGANICS	4-Chloroaniline	SURFACE WATER
SEMIVOLATILE ORGANICS	4-Chlorophenyl phenyl ether	SURFACE WATER
SEMIVOLATILE ORGANICS	4-Methylphenol	SURFACE WATER
SEMIVOLATILE ORGANICS	4-Nitroaniline	SURFACE WATER
SEMIVOLATILE ORGANICS	4-Nitrophenol	SURFACE WATER
SEMIVOLATILE ORGANICS	4-Nitrotoluene	SURFACE WATER
SEMIVOLATILE ORGANICS	4-amino-2,6-Dinitrotoluene	SURFACE WATER
SEMIVOLATILE ORGANICS	Acenaphthene	SURFACE WATER
SEMIVOLATILE ORGANICS	Acenaphthylene	SURFACE WATER
SEMIVOLATILE ORGANICS	Anthracene	SURFACE WATER
SEMIVOLATILE ORGANICS	Benzo[a]anthracene	SURFACE WATER
SEMIVOLATILE ORGANICS	Benzo[a]pyrene	SURFACE WATER
SEMIVOLATILE ORGANICS	Benzo[b]fluoranthene	SURFACE WATER
SEMIVOLATILE ORGANICS	Benzo[ghi]perylene	SURFACE WATER
SEMIVOLATILE ORGANICS	Benzo[k]fluoranthene	SURFACE WATER
SEMIVOLATILE ORGANICS	Bis(2-Chloroethoxy)methane	SURFACE WATER
SEMIVOLATILE ORGANICS	Bis(2-Chloroethyl)ether	SURFACE WATER
SEMIVOLATILE ORGANICS	Bis(2-Chloroisopropyl)ether	SURFACE WATER
SEMIVOLATILE ORGANICS	Butylbenzylphthalate	SURFACE WATER
SEMIVOLATILE ORGANICS	Carbazole	SURFACE WATER
SEMIVOLATILE ORGANICS	Chrysene	SURFACE WATER
SEMIVOLATILE ORGANICS	Di-n-octylphthalate	SURFACE WATER
SEMIVOLATILE ORGANICS	Dibenz[a,h]anthracene	SURFACE WATER
SEMIVOLATILE ORGANICS	Dibenzofuran	SURFACE WATER

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Table 6-1
SEAD-16 RI
Analytes Not Detected in Any Sample

Chemical Class	Analyte Name	Media
SEMIVOLATILE ORGANICS	Diethyl phthalate	SURFACE WATER
SEMIVOLATILE ORGANICS	Dimethylphthalate	SURFACE WATER
SEMIVOLATILE ORGANICS	Fluoranthene	SURFACE WATER
SEMIVOLATILE ORGANICS	Fluorene	SURFACE WATER
SEMIVOLATILE ORGANICS	HMX	SURFACE WATER
SEMIVOLATILE ORGANICS	Hexachlorobenzene	SURFACE WATER
SEMIVOLATILE ORGANICS	Hexachlorobutadiene	SURFACE WATER
SEMIVOLATILE ORGANICS	Hexachlorocyclopentadiene	SURFACE WATER
SEMIVOLATILE ORGANICS	Hexachloroethane	SURFACE WATER
SEMIVOLATILE ORGANICS	Indeno[1,2,3-cd]pyrene	SURFACE WATER
SEMIVOLATILE ORGANICS	Isophorone	SURFACE WATER
SEMIVOLATILE ORGANICS	N-Nitrosodiphenylamine	SURFACE WATER
SEMIVOLATILE ORGANICS	N-Nitrosodipropylamine	SURFACE WATER
SEMIVOLATILE ORGANICS	Naphthalene	SURFACE WATER
SEMIVOLATILE ORGANICS	Nitrobenzene	SURFACE WATER
SEMIVOLATILE ORGANICS	Phenanthrene	SURFACE WATER
SEMIVOLATILE ORGANICS	Phenol	SURFACE WATER
SEMIVOLATILE ORGANICS	Pyrene	SURFACE WATER
SEMIVOLATILE ORGANICS	RDX	SURFACE WATER
SEMIVOLATILE ORGANICS	Tetryl	SURFACE WATER
VOLATILE ORGANICS	1,1,1-Trichloroethane	SURFACE WATER
VOLATILE ORGANICS	1,1,2,2-Tetrachloroethane	SURFACE WATER
VOLATILE ORGANICS	1,1,2-Trichloroethane	SURFACE WATER
VOLATILE ORGANICS	1,1-Dichloroethane	SURFACE WATER
VOLATILE ORGANICS	1,1-Dichloroethene	SURFACE WATER
VOLATILE ORGANICS	1,2-Dichlorobenzene	SURFACE WATER
VOLATILE ORGANICS	1,2-Dichloroethane	SURFACE WATER
VOLATILE ORGANICS	1,2-Dichloroethene (total)	SURFACE WATER
VOLATILE ORGANICS	1,2-Dichloropropane	SURFACE WATER
VOLATILE ORGANICS	1,3-Dichlorobenzene	SURFACE WATER
VOLATILE ORGANICS	1,4-Dichlorobenzene	SURFACE WATER
VOLATILE ORGANICS	Acetone	SURFACE WATER
VOLATILE ORGANICS	Benzene	SURFACE WATER
VOLATILE ORGANICS	Bromodichloromethane	SURFACE WATER
VOLATILE ORGANICS	Bromoform	SURFACE WATER
VOLATILE ORGANICS	Carbon disulfide	SURFACE WATER
VOLATILE ORGANICS	Carbon tetrachloride	SURFACE WATER
VOLATILE ORGANICS	Chlorobenzene	SURFACE WATER
VOLATILE ORGANICS	Chlorodibromomethane	SURFACE WATER
VOLATILE ORGANICS	Chloroethane	SURFACE WATER
VOLATILE ORGANICS	Chloroform	SURFACE WATER
VOLATILE ORGANICS	Cis-1,3-Dichloropropene	SURFACE WATER
VOLATILE ORGANICS	Ethyl benzene	SURFACE WATER
VOLATILE ORGANICS	Methyl bromide	SURFACE WATER
VOLATILE ORGANICS	Methyl butyl ketone	SURFACE WATER
VOLATILE ORGANICS	Methyl chloride	SURFACE WATER
VOLATILE ORGANICS	Methyl ethyl ketone	SURFACE WATER
VOLATILE ORGANICS	Methyl isobutyl ketone	SURFACE WATER

Table 6-1
SEAD-16 RI
Analytes Not Detected in Any Sample

Chemical Class	Analyte Name	Media
VOLATILE ORGANICS	Methylene chloride	SURFACE WATER
VOLATILE ORGANICS	Styrene	SURFACE WATER
VOLATILE ORGANICS	Tetrachloroethene	SURFACE WATER
VOLATILE ORGANICS	Toluene	SURFACE WATER
VOLATILE ORGANICS	Total Xylenes	SURFACE WATER
VOLATILE ORGANICS	Trans-1,3-Dichloropropene	SURFACE WATER
VOLATILE ORGANICS	Trichloroethene	SURFACE WATER
VOLATILE ORGANICS	Vinyl chloride	SURFACE WATER

deleted from that database. This statistical analysis was applied only to the inorganic analytes in the soil, solids, and groundwater databases. All were compared to background databases.

The Wilcoxon Rank Sum test (WRS test) is the statistical method that was used to compare the on-site soil and solids datasets to the background soil dataset and the site groundwater dataset to the background groundwater dataset. The basis for this statistical comparison was obtained from the EPA Guidance document *Statistical Methods For Evaluating The Attainment Of Cleanup Standards* (EPA, 1994) and *Statistical Methods For Environmental Pollution Monitoring* (Gilbert, 1987). Although no site-specific EPA approval was granted to apply the WRS test in this situation, the use of the WRS test as a statistical method to determine if there is a difference between contaminant concentrations in background areas and SEAD-16 is reasonable and appropriate. This form of evaluation is consistent with guidance cited in RAGS (EPA 1989a).

The hypotheses used in the application of the WRS test are:

Ho (the null hypothesis):	The populations from which the two data sets have been drawn have the same mean.
Ha (the alternative hypothesis):	The measurements from the site population tend to exceed those from the background populations.

where Ho is assumed to be true unless the test indicates Ho should be rejected in favor of Ha. If Ho cannot be rejected, then it is accepted that the distribution of measurements in the background area is very similar in shape and central tendency (average) to the distribution of measurements in the area being investigated. The WRS test does not require that either data set be normally distributed.

The WRS test is performed by first listing the combined background and on-site measurements from smallest to largest and assigning the ranks 1,2 etc., to the ordered values. The test handles non-detect values by treating them as ties. The methodology for treatment of ties recommended by Gilbert (1987) was followed. The ranks of the measurements from the cleanup unit are summed and used to compute the statistic Z_{rs}, which is compared to a critical value ($Z_{1-\alpha}$) from the standard normal distribution. The Z_{rs} statistic is calculated from the following formula:

$$Z_{RS} = \frac{W_{RS} - n(N+1)/2}{\left\{\frac{mn}{12}\left[N+1-\frac{\sum_{j=1}^{g} t_j\left(t_j^2-1\right)}{N(N-1)}\right]\right\}^{1/2}}$$

where:

m = number of samples in the background dataset

n = number of samples in the on-site dataset

N = m+n

W_{rs} = the Wilcoxon Rank Sum of the on-site dataset

g = the number of tied groups

t_j = the number of tied data in the jth group

The critical value $Z_{1-\alpha}$ defines the probability that the WRS test will correctly indicate that the site and background datasets are drawn from the same population. The possibility that the WRS test will yield a false result (i.e., reject the null hypothesis when it is true) is defined by α. This type of error is called a Type I error. The overall Type I error rate (α) was selected as 0.05, which represents the 95% confidence interval. $Z_{1-\alpha}$ is found from Cumulative Standard Normal Distribution statistical tables. For a Type I error rate of 0.05, $Z_{1-\alpha}$ (or $Z_{.95}$) is equal to 1.645. If the calculated Z_{rs} statistic for a particular analyte is less than $Z_{1-\alpha}$ (1.645), the null hypothesis cannot be rejected. It is therefore concluded that, at the 95% confidence level, the measurements of that analyte in the on-site population do not tend to exceed the measurements of that analyte in the background population and that analyte is eliminated from the database.

Based upon the results of the WRS test, eight inorganic analytes were found to occur in the SEAD 16 soil datasets at concentrations that tend to be above those observed in the background soil measurements. They are antimony, barium, copper, lead, mercury, selenium, thallium and zinc.

Thirteen inorganic analytes were found to occur in the SEAD-16 solids dataset at concentrations that tend to be above those observed in the background soil measurements. They are antimony, arsenic, barium, cadmium, copper, cyanide, lead, mercury, selenium, silver, sodium, thallium, and zinc.

For the groundwater samples, only those samples with turbidities below 50 NTUs were considered in the evaluation of site groundwater data. See Section 6.2.1.1, Background Sampling, for a discussion addressing the use of low turbidity groundwater samples. Three inorganic analytes were found to occur in the SEAD-16 groundwater dataset at concentrations that tend to be above those observed in the background groundwater measurements. They are copper, lead, and thallium. It should be noted that several of the analytes that were detected in SEAD-16 groundwater were not detected in a sufficient number of samples for the WRS to have sufficient power to accurately determine whether two sample sets are drawn from the same population. (See Gilbert, 1987, for a complete explanation of the requirements and constraints of using the WRS test.) These analytes are antimony, arsenic, cadmium, selenium, and zinc. The statistical data for these five analytes show that the detected concentrations and their frequencies of detection are similar to those found in the background data. Antimony was detected on-site with the same frequency as in the background dataset (18%), and its mean (3.8ug/L) and maximum (12.3 ug/L) on-site concentrations were below the mean (8.8 ug/L) and maximum (44.7ug/L) background concentrations. Arsenic was detected on-site in 9% of the samples and was detected in 7% of the background samples, and its mean (1.9 ug/L) and maximum (3.2 ug/L) on-site concentrations were slightly above and below their respective background mean (1.5 ug/L) and maximum (9.3 ug/L) concentrations. Cadmium was not detected in background and was only detected in one on-site sample at a concentration that was one quarter (0.23 ug/L) of the sample quantitaion limit (1U ug/L) for the background samples. Selenium was detected on-site in 9% of the samples and was detected in 15% of the background samples, and its mean (1.9 ug/L) and maximum (2.8 ug/L) on-site concentrations were slightly above and below their respective background mean (1.4 ug/L) and maximum (3.6 ug/L) concentrations. Zinc was detected on-site in only 9% of the samples while it was detected in 88% of the background samples, and its mean (11.9 ug/L) and maximum (42 ug/L) on-site concentrations were below the mean (25.4 ug/L) and maximum (143 ug/L) background concentrations. This review of the statistical data for each element demonstrates that the site data and background data are very similar and that the concentrations and distributions of inorganic analytes that were detected on-site, except copper, lead, and thallium, are indistinguishable from background.

Following comments received by the USEPA, the mean of the site groundwater data were also compared to the mean of the background data. Using the methodology suggested by the USEPA, any analyte that was found in site groundwater with a mean concentration that was greater than twice the mean background concentration for that analyte was also considered in the baseline risk assessment. Using this methodology, the three analytes listed above (copper, lead, and thallium), as well as sodium, were found to occur with mean groundwater concentrations that were greater than twice their respective mean background concentrations. Therefore, copper, lead, thallium and sodium were not eliminated from the groundwater database and EPCs were calculated for these four analytes, which were subsequently included in the baseline risk assessment for SEAD-16.

Tables 6-2A, 6-2B, 6-2C, 6-2D, and 6-2E summarize the results of statistical comparisons, the Z_{rs} statistic calculations and the Z_{rs} to $Z_{1-\alpha}$ comparisons for the surface soil dataset, the total soils dataset, the zero to four foot soils dataset, the solids dataset, and the groundwater dataset, respectively.

6.2.4 Data Quantification for Use in the Risk Assessment

After eliminating inorganic analytes present at background levels from the risk assessment, exposure point concentrations (EPCs) were calculated for each of the remaining detected analytes in each media at SEAD 16. EPCs for both the reasonable maximum exposure (RME) and central tendency (CT) risk calculations are equal to the 95 percent upper confidence limit (UCL) of the arithmetic mean of the concentration (EPA, May 1992).

Background samples were excluded from the calculation of EPCs. Samples from MW16-1 were excluded from the EPC calculations for groundwater of SEAD-16. There were no background samples of soil, surface water or sediment collected.

The analytical results of each pair of samples and duplicate samples were averaged to produce single sets of results used to calculate EPCs for each detected analyte. The following logic was used to average the results of samples and their duplicate samples:

- If an analyte was detected in both the sample and duplicate sample, then the detected values were averaged.
- If an analyte was not detected in either the sample or duplicate sample, then the sample quantitation limits (SQLs) were averaged.
- If an analyte was detected in only one sample of a sample-duplicate pair and the SQL of the other sample was less than four times the detected value, then the analyte was considered present at a level equal to the average of the detected value and one-half of the SQL.

Table 6-2A
SEAD 16 RI
Inorganics Statistical Analyses
(Wilcoxon Ranked Sum Test)

Surface Soil Medium

Metals	Number of site samples n	Number of background samples m	Total samples N (m+n)	Mean n (ug/kg)	Mean m (ug/kg)	Stddev n (ug/kg)	Stddev m (ug/kg)	Min. n (ug/kg)	Min. m (ug/kg)	Max. n (ug/kg)	Max. m (ug/kg)	Mean Rank n	Mean Rank m	Wilcoxon Rank Sum n	Wilcoxon Rank Sum m	Zrs	Z(1-alpha)	Reject Null Hypothesis?
Aluminum	52	60	112	10740.96	13397.33	2947.71	4521.01	3860	5560	17200	21200	46.33	65.32	2409.16	3919.2	-3.0865	1.645	NO
Antimony	55	60	115	43.36	2.81	259.76	2.88	0.17	0.07	1930	17.1	63.77	52.71	3507.35	3162.6	1.7779	1.645	YES
Arsenic	56	57	113	6.8	5.42	5.32	2.7	2.9	2.7	32.2	21.5	61.07	53	3419.92	3021	1.31	1.645	NO
Barium	55	60	115	433.19	81.05	1417.92	26.72	27.2	33.9	9340	159	66.65	50.08	3665.75	3004.8	2.6624	1.645	YES
Beryllium	56	60	116	0.41	0.66	0.16	0.25	0.01	0.27	0.91	1.4	41.74	74.14	2337.44	4448.4	-5.1865	1.645	NO
Cadmium	53	54	107	0.96	0.58	2.51	0.72	0.03	0.01	16.6	2.9	54.57	53.44	2892.21	2885.76	0.187	1.645	NO
Calcium	56	60	116	49676.78	48899.83	55162.85	50547.15	3140	1370	260000	293000	58.96	58.08	3301.76	3484.8	0.1409	1.645	NO
Chromium	55	60	115	21.59	20.41	8.87	6.42	8.4	10.3	47.5	35.8	59.09	57	3249.95	3420	0.336	1.645	NO
Cobalt	56	60	116	10.06	11.09	3.04	4.27	4.6	7900	17.8	29.1	55.06	61.71	3083.36	3702.6	-1.0637	1.645	NO
Copper	56	60	116	895.9	21.94	5059.01	8.62	14.9	9.7	37900	62.8	80.62	37.86	4514.72	2271.6	6.8429	1.645	YES
Cyanide	56	54	110	0.29	0.28	0.16	0.04	0.22	0.21	1.5	0.41	52.56	58.55	2943.36	3161.7	-0.985	1.645	NO
Iron	56	60	116	22445.17	24656.16	5639.41	7470.55	8870	8770	36500	42500	54.18	62.53	3034.08	3751.8	-1.3371	1.645	NO
Lead	56	57	113	3498.04	21.6	18697.8	47.75	8.5	5.4	140000	269	82.72	31.73	4632.32	1808.61	8.2728	1.645	YES
Magnesium	56	60	116	9259.64	11027.66	8755.91	6826.1	3130	2830	56000	34900	51.5	65.03	2884	3901.8	-2.1658	1.645	NO
Manganese	56	60	116	505.44	555.46	520.63	324.54	178	207	4140	2380	46.42	61.43	2599.52	3685.8	-2.5094	1.645	NO
Mercury	56	56	112	0.61	0.05	1.64	0.07	0.01	0.005	11.4	0.5	71.46	41.54	4001.76	2326.24	4.8941	1.645	YES
Nickel	56	60	116	32.81	30.83	18.9	10.89	12.3	12.3	148	62.3	59.18	57.87	3314.08	3472.2	0.21	1.645	NO
Potassium	56	60	116	1322.33	1612.98	403.97	590.06	599	628	2300	3460	50.02	66.42	2801.12	3985.2	-2.6246	1.645	NO
Selenium	56	57	113	0.6	0.39	0.47	0.44	0.06	0.045	1.6	2.1	65.66	48.49	3676.96	2763.93	2.786	1.645	YES
Silver	56	57	113	0.52	0.34	1.46	0.26	0.1	0.04	11.1	0.87	57.63	56.38	3227.28	3213.66	0.2039	1.645	NO
Sodium	56	60	116	128.64	91.24	242.05	54.92	20.55	8.45	1830	269	59.27	57.78	3319.12	3466.8	0.2376	1.645	NO
Thallium	56	60	116	0.82	0.27	2.18	0.23	0.07	0.075	16.6	1.2	70.32	47.47	3937.92	2848.2	3.6593	1.645	YES
Vanadium	56	60	116	22.39	22.11	8.32	6.84	8.2	11.5	61.9	36.9	58.03	58.94	3249.68	3536.4	-0.1464	1.645	NO
Zinc	56	57	113	482.34	75.36	1950.81	27.82	42.7	36.2	14600	219	73.41	40.88	4110.96	2330.16	5.2776	1.645	YES

Table 6-2B
SEAD 16 RI
Inorganics Statistical Analyses
(Wilcoxon Ranked Sum Test)

All Soils Medium

Metals	Number of site samples n	Number of background samples m	Total samples N (m+n)	Mean n (ug/kg)	Mean m (ug/kg)	Stddev n (ug/kg)	Stddev m (ug/kg)	Min. n (ug/kg)	Min. m (ug/kg)	Max. n (ug/kg)	Max. m (ug/kg)	Mean Rank n	Mean Rank m	Wilcoxon Rank Sum n	Wilcoxon Rank Sum m	Zrs	Z(1-alpha)	Reject Null Hypothesis?
Aluminum	53	60	113	10779.81	13397.33	2932.9	4521.01	3860	5560	17200	21200	47	65.83	2491	3950	-3.0495	1.645	NO
Antimony	61	60	121	41.51	2.81	246.99	2.88	0.17	0.07	1930	17.1	66.5	55.41	4057	3325	1.7395	1.645	YES
Arsenic	62	57	119	6.68	5.42	5.08	2.7	2.9	2.7	32.2	21.5	64.31	55.31	3987	3153	1.4237	1.645	NO
Barium	61	60	121	404.65	81.05	1348.24	26.72	27.2	33.9	9340	159	70.15	51.7	4279	3102	2.8928	1.645	YES
Beryllium	62	60	122	0.41	0.66	0.15	0.25	0.01	0.27	0.91	1.4	44.27	79.3	2745	4758	-5.4709	1.645	NO
Cadmium	59	54	113	0.87	0.58	2.39	0.72	0.03	0.01	16.6	2.9	55.74	58.38	3289	3153	-0.4283	1.645	NO
Calcium	62	60	122	49298.38	48899.83	53123.39	50547.15	3140	1370	260000	293000	62.11	60.87	3851	3652	0.1946	1.645	NO
Chromium	61	60	121	21.27	20.41	8.5	6.42	8.4	10.3	47.5	35.8	61.56	60.43	3755	3626	0.1763	1.645	NO
Cobalt	62	60	122	10.12	11.09	2.94	4.27	4.6	5.2	17.8	29.1	58.65	64.44	3636	3866	-0.904	1.645	NO
Copper	62	60	122	826.54	21.94	4809.19	8.62	14.9	9.7	37900	62.8	83.15	39.13	5155	2348	6.8728	1.645	YES
Cyanide	62	54	116	0.3	0.28	0.16	0.04	0.22	0.21	1.5	0.41	55.55	61.89	3444	3342	-1.0144	1.645	NO
Iron	62	60	122	22637.58	24656.16	5517.63	7470.55	8870	8770	36500	42500	57.71	65.42	3578	3925	-1.2035	1.645	NO
Lead	62	57	119	3749.77	21.6	18240.55	47.75	8.5	5.4	140000	269	85.47	32.3	5299	1841	8.4	1.645	YES
Magnesium	62	60	122	9303.7	11027.66	8362.34	6826.1	3130	2830	5600	34900	55.23	67.98	3424	4079	-1.9922	1.645	NO
Manganese	62	50	112	502.08	555.46	497.05	324.54	178	207	4140	2380	49.96	64.61	3098	3231	-2.3734	1.645	NO
Mercury	62	56	118	0.6	0.05	1.57	0.07	0.01	0.005	11.4	0.5	73.87	43.59	4580	2441	4.8186	1.645	YES
Nickel	62	60	122	32.53	30.83	18.03	10.89	12.3	12.3	148	62.3	62.29	60.68	3862	3641	0.2509	1.645	NO
Potassium	62	60	122	1329.85	1612.98	394.37	590.06	599	628	2300	3460	53.42	69.85	3312	4191	-2.5659	1.645	NO
Selenium	62	57	119	0.59	0.39	0.46	0.44	0.06	0.045	1.6	2.1	69.02	50.19	4279	2861	2.9745	1.645	YES
Silver	62	57	119	0.5	0.34	1.39	0.26	0.1	0.04	11.1	0.87	60.3	59.68	3739	3402	0.0984	1.645	NO
Sodium	62	60	122	122.44	91.24	231.11	54.92	20.55	8.45	1830	269	61.27	61.73	3799	3704	-0.0717	1.645	NO
Thallium	62	60	122	1.5	0.27	5.87	0.23	0.07	0.075	44.1	1.2	74.53	48.03	4621	2882	4.1396	1.645	YES
Vanadium	62	60	122	22.02	22.11	8.01	6.84	8.2	11.5	61.9	36.9	60.24	62.8	3735	3768	-0.3995	1.645	NO
Zinc	62	57	119	446.66	75.36	1855.7	27.82	42.7	36.2	14600	219	76.05	42.54	4715	2425	5.293	1.645	YES

Table 6-2C
SEAD 16 RI
Inorganics Statistical Analyses
(Wilcoxon Ranked Sum Test)

Zero to Four Foot Soil Medium

Metals	Number of site samples n	Number of background samples m	Total samples N (m+n)	Mean n (ug/kg)	Mean m (ug/kg)	Stddev n (ug/kg)	Stddev m (ug/kg)	Min. n (ug/kg)	Min. m (ug/kg)	Max. n (ug/kg)	Max. m (ug/kg)	Mean Rank n	Mean Rank m	Wilcoxon Rank Sum n	Wilcoxon Rank Sum m	Zrs	Z(1-alpha)	Reject Null Hypothesis?
Aluminum	52	60	112	10740.96	13397.33	2947.71	4521.01	3860	5560	17200	21200	46.33	65.32	2409	3919	-3.0865	1.645	NO
Antimony	60	60	120	42.14	2.81	249.03	2.88	0.17	0.07	1930	17.1	66.03	54.97	3962	3298	1.7401	1.645	YES
Arsenic	61	57	118	6.69	5.42	5.12	2.7	2.9	2.7	32.2	21.5	63.6	55.11	3880	3141	1.3471	1.645	NO
Barium	60	60	120	409.31	81.05	1359.12	26.72	27.2	33.9	9340	159	69.36	51.64	4162	3098	2.7897	1.645	YES
Beryllium	61	60	121	0.41	0.66	0.15	0.25	0.01	0.27	0.91	1.4	43.79	78.5	2671	4710	-5.4448	1.645	NO
Cadmium	58	54	112	0.89	0.58	2.41	0.72	0.03	0.01	16.6	2.9	55.38	57.7	3212	3116	-0.3785	1.645	NO
Calcium	61	60	121	49737.7	48899.83	53450.58	50547.15	3140	1370	260000	293000	61.73	60.26	3766	3616	0.2307	1.645	NO
Chromium	60	60	120	21.28	20.41	8.57	6.42	8.4	10.3	47.5	35.8	61.03	59.97	3662	3598	0.168	1.645	NO
Cobalt	61	60	121	10.09	11.09	2.96	4.27	4.6	5.2	17.8	29.1	57.9	64.15	3532	3849	-0.9799	1.645	NO
Copper	61	60	121	839	21.94	4848.09	8.62	14.9	9.7	37900	62.8	82.51	39.13	5033	2348	6.8017	1.645	YES
Cyanide	61	54	115	0.3	0.28	0.16	0.04	0.22	0.21	1.5	0.41	55.28	61.07	3372	3298	-0.9137	1.645	NO
Iron	61	60	121	22493.93	24656.16	5445.27	7470.55	8870	8770	36500	42500	56.85	65.22	3468	3913	-1.3116	1.645	NO
Lead	61	57	118	3806.18	21.6	18386.47	47.75	8.5	5.4	140000	269	84.92	32.3	5180	1841	8.3506	1.645	YES
Magnesium	61	60	121	9354.09	11027.66	8422.24	6826.1	3130	2830	56000	34900	54.84	67.27	3345	4036	-1.9493	1.645	NO
Manganese	61	50	111	500.7	555.46	501.06	324.54	178	207	4140	2380	49.19	64.31	3001	3216	-2.4627	1.645	NO
Mercury	61	56	117	0.6	0.05	1.59	0.07	0.01	0.005	11.4	0.5	73.16	43.57	4463	2440	4.7311	1.645	YES
Nickel	61	60	121	32.5	30.83	18.18	10.89	12.3	12.3	148	62.3	61.62	60.37	3759	3622	0.197	1.645	NO
Potassium	61	60	121	1330.18	1612.98	397.64	590.06	599	628	2300	3460	52.89	69.25	3226	4155	-2.5664	1.645	NO
Selenium	61	57	118	0.58	0.39	0.46	0.44	0.06	0.045	1.6	2.1	68.25	50.13	4163	2857	2.8766	1.645	YES
Silver	61	57	118	0.51	0.34	1.4	0.26	0.1	0.04	11.1	0.87	59.98	58.99	3659	3362	0.1562	1.645	NO
Sodium	61	60	121	124	91.24	232.69	54.92	20.55	8.45	1830	269	61.15	60.85	3730	3651	0.0467	1.645	NO
Thallium	61	60	121	1.51	0.27	5.92	0.23	0.07	0.075	44.1	1.2	73.9	47.88	4508	2873	4.0816	1.645	YES
Vanadium	61	60	121	22.07	22.11	8.07	6.84	8.2	11.5	61.9	36.9	59.87	62.15	3652	3729	-0.3577	1.645	NO
Zinc	61	57	118	452.03	75.36	1870.62	27.82	42.7	36.2	14600	219	75.38	52.51	4598	2993	5.2159	1.645	YES

Table 6-2D
SEAD 16 RI
Inorganics Statistical Analyses
(Wilcoxon Ranked Sum Test)

Solids Medium

Metals	Number of site samples n	Number of background samples m	Total samples N (m+n)	Mean n (ug/kg)	Mean m (ug/kg)	Stddev n (ug/kg)	Stddev m (ug/kg)	Min. n (ug/kg)	Min. m (ug/kg)	Max. n (ug/kg)	Max. m (ug/kg)	Mean Rank n	Mean Rank m	Wilcoxon Rank Sum n	Wilcoxon Rank Sum m	Zrs	Z(1-alpha)	Reject Null Hypothesis?
Aluminum	8	60	68	9765	13397.33	4188.72	4521.01	2960	5560	16500	21200	22.38	36.12	179	2167.2	-1.8466	1.645	NO
Antimony	12	60	72	372.4	2.81	568.6	2.88	2.3	0.07	1560	17.1	63.75	31.05	765	1863	4.9422	1.645	YES
Arsenic	12	57	69	12.31	5.42	13.08	2.7	1.3	2.7	47.3	21.5	46.54	32.57	559	1856.49	2.1934	1.645	YES
Barium	12	60	72	5888.85	81.05	11806.36	26.72	88.2	33.9	40500	159	64.58	30.88	775	1852.8	5.0923	1.645	YES
Beryllium	12	60	72	0.35	0.66	0.31	0.25	0.02	0.27	1.1	1.4	17.71	40.26	213	2415.6	-3.4082	1.645	NO
Cadmium	8	54	62	32.68	0.58	47.63	0.72	0.41	0.01	127	2.9	53.19	28.29	426	1527.66	3.6437	1.645	YES
Calcium	12	60	72	53539.67	48899.83	60502.24	50547.15	586	1370	215000	293000	36.92	36.42	443	2185.2	0.0756	1.645	NO
Chromium	8	60	68	111.89	20.41	178.49	6.42	4.3	10.3	518	35.8	44.25	33.2	354	1992	1.4848	1.645	NO
Cobalt	12	60	72	13.14	11.09	11.17	4.27	2.7	5.2	40.6	29.1	33.46	37.11	402	2226.6	-0.5516	1.645	NO
Copper	12	60	72	11997.26	21.94	24685.53	8.62	90	9.7	81400	62.8	66.5	30.5	798	1830	5.44	1.645	YES
Cyanide	12	54	66	3.8	0.28	6.98	0.04	0.29	0.21	24.2	0.41	57.08	28.26	685	1526.04	4.7098	1.645	YES
Iron	12	60	72	38400.83	24656.16	25671.59	7470.55	2690	8770	79700	42500	45.13	34.78	542	2086.8	1.5639	1.645	NO
Lead	12	57	69	82113.58	21.6	187799.42	47.75	132	5.4	527000	269	63.33	29.04	760	1655.28	5.3842	1.645	YES
Magnesium	12	60	72	11445	11027.66	5847.35	6826.1	2470	2830	19700	34900	38.83	36.03	466	2161.8	0.4231	1.645	NO
Manganese	12	50	62	422.78	555.46	251.51	324.54	27.3	207	1040	2380	25.33	32.98	304	1649	-1.3186	1.645	NO
Mercury	12	56	68	6.23	0.05	12.52	0.07	0.035	0.005	39.3	0.5	58.46	29.37	702	1644.72	4.6489	1.645	YES
Nickel	12	60	72	53.89	30.83	51.5	10.89	2.1	12.3	154	62.3	37.5	36.3	450	2178	0.1813	1.645	NO
Potassium	12	60	72	9284.17	1612.98	22625.68	590.06	636	628	80600	3460	43.83	35.03	526	2101.8	1.3299	1.645	NO
Selenium	12	57	69	1.39	0.39	1.51	0.44	0.065	0.045	5.8	2.1	51.33	31.56	616	1798.92	3.104	1.645	YES
Silver	12	57	69	3.68	0.34	7.06	0.26	0.145	0.04	22.7	0.87	49.21	32.01	591	1824.57	2.7008	1.645	YES
Sodium	12	60	72	1557.42	91.24	1734.63	54.92	63.1	8.45	4440	269	60	31.8	720	1908	4.2611	1.645	YES
Thallium	12	60	72	0.48	0.27	0.41	0.23	0.11	0.075	1.4	1.2	48	34.2	576	2052	2.0861	1.645	YES
Vanadium	12	60	72	14.48	22.11	11.34	6.84	0.5	11.5	44	36.9	19.63	39.88	236	2392.8	-3.06	1.645	NO
Zinc	12	57	69	8965.25	75.36	14827.96	27.82	178	36.2	42600	219	63.42	29.02	761	1654.14	5.3985	1.645	YES

Table 6-2E
SEAD-16 Remedial Investigation
Comparison of Site Groundwater Data to Background Groundwater Data
Samples with NTUs of 50 or less

Parameter	Number of Site Samples (n)	Number of Background Samples (m)	Total Samples (n+m)	Mean n (ug/L)	Mean m (ug/L)	Frequency of detection - SITE	Frequency of detection - BACKGROUND	Max. n (ug/L)	Max. m (ug/L)	mean rank n	mean rank m	Wilcoxon Rank Sum n	Wilcoxon Rank Sum m	Zrs	Z(1-alpha)	Reject Null Hypothesis?	Is the site mean greater than two times the background mean?
Aluminum	11	28	39	341.675	2,449.11	64%	86%	1470	42,400.00	17.09	21.14	187.99	591.92	-0.99	1.645	NO	NO
Antimony	11	28	39	3.866	8.87	18%	18%	12.3	44.70	21.77	19.3	239.47	540.4	na	1.645	na	NO
Arsenic	11	27	38	1.964	1.52	9%	7%	3.2	9.30	27.86	16.09	306.46	434.43	na	1.645	na	NO
Barium	11	27	38	55.239	73.32	55%	93%	97.4	337.00	17.91	20.15	197.01	544.05	-0.56	1.645	NO	NO
Beryllium	11	26	37	0.141	0.21	46%	12%	0.22	2.20	21.73	17.85	239.03	464.1	1.01	1.645	NO	NO
Cadmium	11	28	39	0.234	1 U	9%	0%	0.32	na	20.82	19.68	229.02	551.04	na	1.645	na	NO
Calcium	11	28	39	109809.09	122,403.17	100%	100%	193000	240,000.00	16.32	21.45	179.52	600.6	-1.21	1.645	NO	NO
Chromium	11	27	38	1.068	4.28	36%	44%	3.4	69.40	18.36	19.96	201.96	538.92	-0.40	1.645	NO	NO
Cobalt	11	28	39	0.905	3.64	36%	43%	1.6	34.60	17.59	20.95	193.49	586.6	-0.82	1.645	NO	NO
Copper	11	28	39	9.648	2.78	55%	46%	56.8	23.30	25.05	18.02	275.55	504.56	1.73	1.645	YES	YES
Cyanide	11	27	38	5 U	5.4 U	0%	0%	na	na	18.5	19.19	203.5	518.13	na	1.645	na	na
Iron	11	28	39	546.955	3,918.51	91%	96%	1900	69,400.00	16	21.57	176	603.96	-1.37	1.645	NO	NO
Lead	11	27	38	5.959	2.65	55%	33%	24.1	34.80	27	16.44	297	443.88	2.66	1.645	YES	YES
Magnesium	11	28	39	15015.455	26,818.63	100%	100%	23700	57,600.00	12.41	22.98	136.51	643.44	-2.60	1.645	NO	NO
Manganese	11	28	39	239.173	193.74	91%	96%	1380	1,120.00	20.55	19.79	226.05	554.12	0.18	1.645	NO	NO
Mercury	11	26	37	.1 U	0.04	0%	12%	na	0.05	26.5	15.83	291.5	411.58	na	1.645	na	na
Nickel	11	28	39	3.195	6.75	55%	50%	11	99.80	21.18	19.54	232.98	547.12	0.40	1.645	NO	NO
Potassium	11	27	38	4081.136	3,321.86	64%	93%	18800	10,200.00	19.82	19.37	218.02	522.99	0.11	1.645	NO	NO
Selenium	11	27	38	1.868	1.41	9%	15%	2.8	3.60	23.36	17.93	256.96	484.11	na	1.645	na	NO
Silver	11	28	39	1.4 U	1.18	0%	4%		0.68	20.55	19.79	226.05	554.12	na	1.645	na	na
Sodium	11	28	39	86704.545	19,364.92	100%	96%	409000	73,500.00	23.82	18.5	262.02	518	1.31	1.645	NO	YES
Thallium	11	27	38	4.07	1.71	36%	15%	9.2	5.70	28.77	15.72	316.47	424.44	3.30	1.645	YES	YES
Vanadium	11	28	39	1.455	5.20	36%	43%	3.8	70.80	19.27	20.29	211.97	568.12	-0.25	1.645	NO	NO
Zinc	11	25	36	11.905	25.43	9%	88%	42	143.00	12.8	16.04	140.8	401	na	1.645	na	NO

NOTES 1) na = The frequency of detection is too low to make a valid statistical comparison.

- If an analyte was detected in only one sample of a sample-duplicate pair and the SQL of the other sample was greater than or equal to four times the detected value, then the analyte was considered present at the detected level.

The EPC, or the 95% UCL of the mean concentration, was calculated for each analyte using the following algorithm:

1. A list of concentrations was tabulated for each detected analyte using one-half of the SQL for all negative results.
2. Each analyte distribution was tested for normality by either the Shapiro-Wilk Test for less than or equal to 50 samples, or the D'Agostino Test for more than 50 samples (Gilbert, 1987, pp. 158-162). A normal distribution was assumed if the distribution passed the test at the 0.05 significance level, otherwise the distribution was assumed to be lognormal.
3. The 95 percent UCL of the mean was calculated using the t-statistic for normal distributions or the H-statistic for lognormal distributions (see Gilbert, 1987). If the 95 percent UCL of the mean exceeded the maximum detected concentration, then the following steps were executed.
4. The set of results was tested for unusually high SQLs. An unusually high SQL was assumed to exceed 1.5 times the average SQL.
5. If an unusually high SQL was present and the 95 percent UCL of the mean exceeded the maximum detected concentration, then the sample with the highest SQL was excluded from the data set and the statistics were re-calculated (1 through 4, above).
6. Analytical results with unusually high SQLs were removed one-by-one until either (a) the 95 percent UCL of the mean no longer exceeded the maximum detected concentration or (b) no more unusually high SQLs were present.
7. In cases where the final 95 percent UCL exceeded the maximum detected concentration, the maximum detected concentration was selected as the EPC. In these cases, the maximum detected concentration is believed to be a better conservative (upper bound) estimate of the mean than the established 95% UCL for various reasons, including small sample populations, small number of detected values, poor knowledge of the underlying statistical distribution based on available data, and variable SQLs.

Table 6-3 lists the chemicals of potential concern for the baseline human health and ecological risk assessments in all soils, surface soils (0 to 6 inches), surface water, sediment, and groundwater. For each analyte detected in each sample medium, this table presents the number

TABLE 6-3A

Indoor Air Exposure Point Concentration Summary

SEAD 16 - Remedial Investigation
Seneca Army Depot Activity

Analyte	No. of Valid Analyses	No. of Hits	Frequency (%)	Mean (mg/m3)	Standard Deviation (mg/m3)	Max Hit (mg/m3)	Exposure Point Concentration (EPC)* (mg/m3)
Semivolatile Organics							
Phenol	3	2	67%	4.19E-05	2.03E-05	6.76E-05	6.76E-05
Benzoic Acid	3	1	33%	1.11E-04	2.14E-05	1.41E-04	1.41E-04
Napthalene	3	1	33%	4.53E-05	9.28E-06	5.84E-05	5.84E-05
2-Methylnaphthalene	3	3	100%	5.44E-05	1.21E-05	7.06E-05	7.06E-05
Acenaphthene	3	2	67%	3.06E-05	7.77E-06	3.07E-05	3.07E-05
Dibenzofuran	3	2	67%	2.96E-05	9.03E-06	3.07E-05	3.07E-05
Diethylphthalate	3	3	100%	4.30E-05	1.46E-05	6.14E-05	6.14E-05
Fluorene	3	1	33%	3.51E-05	5.36E-06	2.76E-05	2.76E-05
Phenanthrene	3	1	33%	4.22E-05	4.98E-06	4.91E-05	4.91E-05
Anthracene	3	1	33%	4.12E-05	3.58E-06	4.61E-05	4.61E-05
Di-N-Butylphthalate	3	2	67%	2.86E-05	9.02E-06	2.76E-05	2.76E-05
Butylbenzylphthalate	3	1	33%	3.51E-05	5.36E-06	2.76E-05	2.76E-05
Bis(2-Ethylhexyl)Pthalate	3	3	100%	5.04E-05	2.59E-05	8.71E-05	8.71E-05
Metals							
Aluminum	3	3	100%	1.39E-04	1.05E-05	1.51E-04	1.51E-04
Barium	3	3	100%	1.87E-05	7.67E-07	1.95E-05	1.95E-05
Copper	3	3	100%	1.18E-03	2.77E-04	9.83E-04	9.83E-04
Lead	3	3	100%	3.95E-05	4.38E-06	5.47E-05	5.47E-05
Manganese	3	3	100%	4.93E-06	4.19E-07	5.50E-06	5.50E-06
Mercury	3	2	67%	1.98E-04	5.08E-05	2.35E-04	2.35E-04
Selenium	3	2	67%	4.06E-06	1.71E-06	5.30E-06	5.30E-06

* Special case for indoor air samples: since there are too few data points to perform distributional analysis, the maximum hit concentration was used as an upper bound estimate of exposure.

TABLE 6-3B

Surface Soil Exposure Point Concentration Summary

SEAD 16 - Remedial Investigation
Seneca Army Depot Activity

Analyte	No. of Valid Analyses	No. of Rejected SQLs	No. of Hits	Frequency (%)	Mean (mg/kg)	Standard Deviation (mg/kg)	Max Hit (mg/kg)	Normal?	95% UCL of Mean (mg/kg)	Exposure Point Concentration (EPC)* (mg/kg)
Volatile Organics										
1,1,2,2-Tetrachloroethane	51	0	1	2%	6.10E-03	3.05E-03	7.75E-03	FALSE	6.39E-03	6.39E-03
Acetone	51	0	2	3.90%	6.15E-03	3.45E-03	1.70E-02	FALSE	6.56E-03	6.56E-03
Benzene	49	2	5	10.20%	5.29E-03	1.12E-03	5.00E-03	FALSE	5.76E-03	5.00E-03
Carbon disulfide	49	2	2	4.10%	5.30E-03	1.15E-03	2.00E-03	FALSE	5.99E-03	2.00E-03
Chloroform	48	3	2	4.20%	3.98E-03	1.43E-03	2.00E-03	FALSE	4.41E-03	2.00E-03
Methylene chloride	49	2	3	6.10%	5.37E-03	8.87E-04	3.00E-03	FALSE	5.68E-03	3.00E-03
Toluene	51	0	17	33.30%	5.41E-03	3.67E-03	1.00E-02	FALSE	6.47E-03	6.47E-03
Xylene (total)	49	2	1	2.00%	5.53E-03	5.64E-04	4.25E-03	FALSE	5.66E-03	4.25E-03
Semivolatile Organics										
2,4-Dinitrotoluene**	51	0	18	35.30%	3.96E+00	1.34E+01	8.50E+01	FALSE	4.55E+00	4.55E+00
2,6-Dinitrotoluene**	51	0	10	19.60%	1.59E+00	6.45E+00	8.00E+00	FALSE	1.19E+00	1.19E+00
2-Methynaphthalene	51	0	10	19.60%	1.04E+00	2.93E+00	1.90E+01	FALSE	1.20E+00	1.20E+00
2-Methylphenol	31	20	1	3.20%	1.86E-01	2.32E-02	1.20E-01	FALSE	1.94E-01	1.20E-01
3,3'-Dichlorobenzidine	50	1	1	2.00%	7.12E-01	1.41E+00	8.50E-01	FALSE	7.68E-01	7.68E-01
3-Nitroaniline	50	1	1	2.00%	1.74E+00	3.48E+00	2.10E+00	FALSE	1.87E+00	1.87E+00
Acenaphthene	51	0	10	19.60%	2.06E+00	1.01E+01	7.20E+01	FALSE	1.52E+00	1.52E+00
Acenaphthylene	40	11	9	22.50%	2.18E-01	1.47E-01	3.10E-01	FALSE	3.05E-01	3.05E-01
Anthracene	51	0	14	27.50%	3.01E+00	1.68E+01	1.20E+02	FALSE	1.55E+00	1.55E+00
Benzo[a]anthracene	51	0	27	52.90%	4.95E+00	3.07E+01	2.20E+02	FALSE	2.70E+00	2.70E+00
Benzo[a]pyrene	51	0	29	56.90%	4.64E+00	2.79E+01	2.00E+02	FALSE	3.40E+00	3.40E+00
Benzo[b]fluoranthene	51	0	28	54.90%	4.71E+00	2.79E+01	2.00E+02	FALSE	3.61E+00	3.61E+00
Benzo[ghi]perylene	51	0	21	41.20%	2.77E+00	1.40E+01	1.00E+02	FALSE	2.29E+00	2.29E+00
Benzo[k]fluoranthene	51	0	25	49.00%	3.95E+00	2.37E+01	1.70E+02	FALSE	2.31E+00	2.31E+00
Carbazole	51	0	13	25.50%	2.40E+00	1.24E+01	8.90E+01	FALSE	1.59E+00	1.59E+00
Chrysene	51	0	34	66.70%	4.93E+00	3.07E+01	2.20E+02	FALSE	2.97E+00	2.97E+00
Di-n-butylphthalate	51	0	18	35.30%	1.81E+00	6.69E+00	1.60E+01	FALSE	1.70E+00	1.70E+00
Dibenz[a,h]anthracene	51	0	14	27.50%	1.50E+00	6.87E+00	4.90E+01	FALSE	1.52E+00	1.52E+00
Dibenzofuran	51	0	10	19.60%	1.63E+00	7.05E+00	5.00E+01	FALSE	1.36E+00	1.36E+00
Diethyl phthalate	31	20	2	6.50%	1.78E-01	4.70E-02	1.90E-02	FALSE	2.41E-01	1.90E-02
Fluoranthene	51	0	35	68.60%	1.11E+01	7.41E+01	5.30E+02	FALSE	3.84E+00	3.84E+00
Fluorene	51	0	6	11.80%	2.20E+00	1.09E+01	7.80E+01	FALSE	1.39E+00	1.39E+00
Indeno[1,2,3-cd]pyrene	51	0	18	35.30%	2.75E+00	1.40E+01	1.00E+02	FALSE	2.38E+00	2.38E+00
N-Nitrosodiphenylamine	51	0	19	37.30%	1.96E+00	7.18E+00	2.50E+01	FALSE	1.85E+00	1.85E+00
Naphthalene	51	0	9	17.60%	1.96E+00	9.25E+00	6.60E+01	FALSE	1.56E+00	1.56E+00
Pentachlorophenol	47	4	1	2.10%	9.16E-01	7.82E-01	1.20E+00	FALSE	1.08E+00	1.08E+00
Phenanthrene	51	0	29	56.90%	1.02E+01	6.85E+01	4.90E+02	FALSE	2.98E+00	2.98E+00
Pyrene	51	0	36	70.60%	7.78E+00	5.03E+01	3.60E+02	FALSE	3.92E+00	3.92E+00
bis(2-Ethylhexyl)phthalate	50	1	11	22.00%	7.24E-01	1.43E+00	2.10E+00	FALSE	1.37E+00	1.37E+00
Pesticides/PCBs										
4,4'-DDD	51	0	8	15.70%	4.33E-03	5.45E-03	2.30E-02	FALSE	4.88E-03	4.88E-03
4,4'-DDE	51	0	36	70.60%	6.17E-02	2.00E-01	1.40E+00	FALSE	1.06E-01	1.06E-01
4,4'-DDT	51	0	35	68.60%	3.43E-02	8.10E-02	3.40E-01	FALSE	4.89E-02	4.89E-02
Aldrin	51	0	2	3.90%	1.84E-03	2.30E-03	5.00E-03	FALSE	1.99E-03	1.99E-03
Aroclor-1254	51	0	2	3.90%	6.09E-02	1.59E-01	1.10E+00	FALSE	5.67E-02	5.67E-02
Aroclor-1260	51	0	9	17.60%	5.34E-02	7.35E-02	3.40E-01	FALSE	6.24E-02	6.24E-02
Dieldrin	51	0	3	5.90%	3.61E-03	4.75E-03	2.60E-02	FALSE	3.93E-03	3.93E-03
Endosulfan I	51	0	20	39.20%	1.27E-02	6.00E-02	4.30E-01	FALSE	9.06E-03	9.06E-03
Endosulfan II	51	0	5	9.80%	3.58E-03	4.32E-03	5.00E-03	FALSE	3.89E-03	3.89E-03
Endosulfan sulfate	51	0	2	3.90%	3.52E-03	4.57E-03	2.00E-02	FALSE	3.77E-03	3.77E-03
Endrin	51	0	6	11.80%	4.42E-03	6.87E-03	4.30E-02	FALSE	4.81E-03	4.81E-03
Endrin aldehyde	51	0	6	11.80%	3.92E-03	4.59E-03	1.40E-02	FALSE	4.41E-03	4.41E-03
Endrin ketone	51	0	6	11.80%	4.67E-03	1.02E-02	7.10E-02	FALSE	4.54E-03	4.54E-03
Heptachlor	50	1	1	2.00%	1.66E-03	2.02E-03	1.80E-03	FALSE	1.77E-03	1.77E-03
Heptachlor epoxide	51	0	6	11.80%	1.97E-03	2.37E-03	6.70E-03	FALSE	2.17E-03	2.17E-03
Toxaphene	50	1	1	2.00%	1.66E-01	2.02E-01	1.80E-01	FALSE	1.77E-01	1.77E-01
alpha-Chlordane	51	0	14	27.50%	6.42E-03	2.37E-02	1.70E-01	FALSE	5.73E-03	5.73E-03
beta-BHC	51	0	3	5.90%	2.04E-03	3.28E-03	2.00E-02	FALSE	2.12E-03	2.12E-03
delta-BHC	51	0	1	2.00%	1.81E-03	2.29E-03	2.20E-03	FALSE	1.97E-03	1.97E-03
gamma-BHC/Lindane	51	0	1	2.00%	1.82E-03	2.29E-03	2.30E-03	FALSE	1.97E-03	1.97E-03
gamma-Chlordane	51	0	12	23.50%	6.96E-03	2.78E-02	2.00E-01	FALSE	5.74E-03	5.74E-03
Nitroaromatics										
2,4-Dinitrotoluene**	51	0	25	49.00%	2.19E+00	1.04E+01	7.40E+01	FALSE	1.92E+00	1.92E+00
2,6-Dinitrotoluene**	51	0	4	7.80%	1.11E-01	2.04E-01	9.00E-01	FALSE	1.07E-01	1.07E-01
2-amino-4,6-Dinitrotoluene	51	0	1	2.00%	9.52E-02	1.73E-01	4.30E-01	FALSE	9.20E-02	9.20E-02
Tetryl	51	0	1	2.00%	9.11E-02	1.67E-01	2.20E-01	FALSE	8.79E-02	8.79E-02
Metals										
Antimony	51	0	33	64.70%	4.75E+01	2.70E+02	1.93E+03	FALSE	4.77E+01	4.77E+01
Barium	51	0	50	98.00%	4.62E+02	1.47E+03	9.34E+03	FALSE	4.11E+02	4.11E+02
Copper	51	0	51	100.00%	9.71E+02	5.30E+03	3.79E+04	FALSE	5.85E+02	5.85E+02
Lead	51	0	51	100.00%	3.79E+03	1.96E+04	1.40E+05	FALSE	6.21E+03	6.21E+03
Mercury	51	0	40	78.40%	6.60E-01	1.72E+00	1.14E+01	FALSE	1.32E+00	1.32E+00
Selenium	51	0	28	54.90%	5.55E-01	4.61E-01	1.60E+00	TRUE	6.63E-01	6.63E-01
Thallium	51	0	16	31.40%	8.40E-01	2.29E+00	1.66E+01	FALSE	9.97E-01	9.97E-01
Zinc	51	0	51	100.00%	5.18E+02	2.04E+03	1.46E+04	FALSE	4.01E+02	4.01E+02
Herbicides										
2,4,5-T	16	0	2	12.50%	3.43E-03	1.71E-03	8.30E-03	FALSE	4.03E-03	4.03E-03
MCPP	16	0	1	6.30%	3.64E+00	3.30E+00	1.60E+01	FALSE	4.33E+00	4.33E+00

* Refer to text for a detailed discussion of EPC determination.

** 2,4-Dinitrotoluene and 2,6-Dinitrotoluene were analyzed for as semivolatile organics and nitroaromatics. The method yielding the higher EPC was used in the risk assessment.

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TABLE 6-3C

Total Soils Exposure Point Concentration Summary

SEAD 16 - Remedial Investigation
Seneca Army Depot Activity

Analyte	No. of Valid Analyses	No. of Rejected	No. of Hits	Frequency (%)	Mean (mg/kg)	Standard Deviation (mg/kg)	Max Hit (mg/kg)	Normal?	95% UCL of Mean (mg/kg)	Exposure Point Concentration (EPC)* (mg/kg)
Volatile Organics										
1,1,2,2-Tetrachloroethane	57	0	1	2%	6.05E-03	2.89E-03	7.75E-03	FALSE	6.30E-03	6.30E-03
Acetone	57	0	4	7%	6.90E-03	6.23E-03	4.60E-02	FALSE	7.28E-03	7.28E-03
Benzene	55	2	7	13%	5.20E-03	1.23E-03	5.00E-03	FALSE	5.70E-03	5.00E-03
Carbon disulfide	55	2	3	6%	5.35E-03	1.03E-03	2.00E-03	FALSE	5.84E-03	2.00E-03
Chloroform	54	3	2	4%	4.11E-03	1.45E-03	2.00E-03	FALSE	4.53E-03	2.00E-03
2-Butanone	55	2	1	2%	5.46E-03	7.99E-04	5.00E-03	FALSE	5.85E-03	5.00E-03
Methylene chloride	55	2	3	6%	5.40E-03	8.41E-04	3.00E-03	FALSE	5.67E-03	3.00E-03
Toluene	57	0	23	40%	5.38E-03	3.57E-03	1.00E-02	FALSE	6.28E-03	6.28E-03
Xylene (total)	55	2	1	2%	5.53E-03	5.36E-04	4.25E-03	FALSE	5.66E-03	4.25E-03
Semivolatile Organics										
2,4-Dinitrotoluene	57	0	20	35%	3.61E+00	1.27E+01	8.50E+01	FALSE	3.80E+00	3.80E+00
2,6-Dinitrotoluene	57	0	11	19%	1.47E+00	6.10E+00	8.00E+00	FALSE	4.25E-03	4.25E-03
2-Methylnaphthalene	57	0	11	19%	9.73E-01	2.77E+00	1.90E+01	FALSE	4.25E-03	4.25E-03
2-Methylphenol	35	22	1	3%	1.86E-01	2.21E-02	1.20E-01	FALSE	1.93E-01	1.20E-01
3,3'-Dichlorobenzidine	56	1	1	2%	6.82E-01	1.34E+00	8.50E-01	FALSE	7.24E-01	7.24E-01
3-Nitroaniline	56	1	1	2%	1.67E+00	3.31E+00	2.10E+00	FALSE	1.76E+00	1.76E+00
Acenaphthene	57	0	11	19%	1.89E+00	9.55E+00	7.20E+01	FALSE	1.33E+00	1.33E+00
Acenaphthylene	45	12	10	22%	2.16E-01	1.39E-01	3.10E-01	FALSE	2.91E-01	2.91E-01
Anthracene	57	0	17	30%	2.74E+00	1.59E+01	1.20E+02	FALSE	1.38E+00	1.38E+00
Benzo[a]anthracene	57	0	31	54%	4.56E+00	2.91E+01	2.20E+02	FALSE	2.46E+00	2.46E+00
Benzo[a]pyrene	57	0	34	60%	4.29E+00	2.64E+01	2.00E+02	FALSE	3.30E+00	3.30E+00
Benzo[b]fluoranthene	57	0	33	58%	4.34E+00	2.64E+01	2.00E+02	FALSE	3.38E+00	3.38E+00
Benzo[ghi]perylene	57	0	26	46%	2.76E+00	1.33E+01	1.00E+02	FALSE	2.70E+00	2.70E+00
Benzo[k]fluoranthene	57	0	30	53%	3.65E+00	2.25E+01	1.70E+02	FALSE	2.24E+00	2.24E+00
Butylbenzylphthalate	35	22	1	3%	1.84E-01	3.45E-02	1.80E-02	FALSE	2.18E-01	1.80E-02
Carbazole	57	0	14	25%	2.19E+00	1.18E+01	8.90E+01	FALSE	1.35E+00	1.35E+00
Chrysene	57	0	39	68%	4.55E+00	2.91E+01	2.20E+02	FALSE	2.77E+00	2.77E+00
Di-n-butylphthalate	57	0	20	35%	1.67E+00	6.34E+00	1.60E+01	FALSE	1.51E+00	1.51E+00
Dibenz[a,h]anthracene	57	0	18	32%	1.43E+00	6.50E+00	4.90E+01	FALSE	1.49E+00	1.49E+00
Dibenzofuran	57	0	12	21%	1.49E+00	6.68E+00	5.00E+01	FALSE	1.17E+00	1.17E+00
Diethyl phthalate	35	22	2	6%	1.79E-01	4.43E-02	1.90E-02	FALSE	2.33E-01	1.90E-02
Fluoranthene	57	0	40	70%	1.02E+01	7.01E+01	5.30E+02	FALSE	3.68E+00	3.68E+00
Fluorene	57	0	7	12%	2.01E+00	1.03E+01	7.80E+01	FALSE	1.22E+00	1.22E+00
Indeno[1,2,3-cd]pyrene	57	0	23	40%	2.66E+00	1.32E+01	1.00E+02	FALSE	2.65E+00	2.65E+00
N-Nitrosodiphenylamine	57	0	20	35%	1.80E+00	6.80E+00	2.50E+01	FALSE	1.59E+00	1.59E+00
Naphthalene	57	0	10	18%	1.80E+00	8.76E+00	6.60E+01	FALSE	1.34E+00	1.34E+00
Pentachlorophenol	53	4	2	4%	9.25E-01	7.96E-01	1.20E+00	FALSE	1.11E+00	1.11E+00
Phenanthrene	57	0	34	60%	9.26E+00	6.48E+01	4.90E+02	FALSE	2.74E+00	2.74E+00
Pyrene	57	0	41	72%	7.17E+00	4.76E+01	3.60E+02	FALSE	3.74E+00	3.74E+00
bis(2-Ethylhexyl)phthalate	57	0	12	21%	1.48E+00	6.09E+00	2.10E+00	FALSE	1.76E+00	1.76E+00
Pesticides/PCBs										
4,4'-DDD	57	0	8	14%	4.66E-03	5.86E-03	2.30E-02	FALSE	5.26E-03	5.26E-03
4,4'-DDE	57	0	37	65%	5.61E-02	1.90E-01	1.40E+00	FALSE	8.51E-02	8.51E-02
4,4'-DDT	57	0	37	65%	3.15E-02	7.70E-02	3.40E-01	FALSE	4.11E-02	4.11E-02
Aldrin	57	0	2	4%	2.06E-03	2.64E-03	5.00E-03	FALSE	2.23E-03	2.23E-03
Aroclor-1254	57	0	2	4%	6.24E-02	1.52E-01	1.10E+00	FALSE	6.00E-02	6.00E-02
Aroclor-1260	57	0	9	16%	5.57E-02	7.45E-02	3.40E-01	FALSE	6.51E-02	6.51E-02
Dieldrin	57	0	4	7%	4.20E-03	5.42E-03	2.60E-02	FALSE	4.65E-03	4.65E-03
Endosulfan I	57	0	22	39%	1.19E-02	5.67E-02	4.30E-01	FALSE	8.65E-03	8.65E-03
Endosulfan II	57	0	5	9%	3.99E-03	4.99E-03	5.00E-03	FALSE	4.34E-03	4.34E-03
Endosulfan sulfate	57	0	2	4%	3.94E-03	5.19E-03	2.00E-02	FALSE	4.23E-03	4.23E-03
Endrin	57	0	7	12%	4.75E-03	7.05E-03	4.30E-02	FALSE	5.23E-03	5.23E-03
Endrin aldehyde	57	0	6	11%	4.29E-03	5.18E-03	1.40E-02	FALSE	4.83E-03	4.83E-03
Endrin ketone	57	0	6	11%	4.97E-03	1.01E-02	7.10E-02	FALSE	4.96E-03	4.96E-03
Heptachlor	54	3	1	2%	1.61E-03	1.95E-03	1.80E-03	FALSE	1.70E-03	1.70E-03
Heptachlor epoxide	57	0	6	11%	2.16E-03	2.69E-03	6.70E-03	FALSE	2.40E-03	2.40E-03
Toxaphene	54	3	1	2%	1.61E-01	1.95E-01	1.80E-01	FALSE	1.70E-01	1.70E-01
alpha-Chlordane	57	0	14	25%	6.16E-03	2.24E-02	1.70E-01	FALSE	5.57E-03	5.57E-03
beta-BHC	57	0	3	5%	2.24E-03	3.43E-03	2.00E-02	FALSE	2.35E-03	2.35E-03
delta-BHC	56	1	1	2%	1.89E-03	2.43E-03	2.20E-03	FALSE	2.03E-03	2.03E-03
gamma-BHC/Lindane	57	0	1	2%	2.04E-03	2.63E-03	2.30E-03	FALSE	2.21E-03	2.21E-03
gamma-Chlordane	57	0	13	23%	6.66E-03	2.64E-02	2.00E-01	FALSE	5.60E-03	5.60E-03
Nitroaromatics										
2,4-Dinitrotoluene	57	0	28	49%	1.98E+00	9.83E+00	7.40E+01	FALSE	1.50E+00	1.50E+00
2,6-Dinitrotoluene	57	0	4	7%	1.06E-01	1.93E-01	9.00E-01	FALSE	1.01E-01	1.01E-01
2-amino-4,6-Dinitrotoluene	57	0	1	2%	9.15E-02	1.64E-01	4.30E-01	FALSE	8.79E-02	8.79E-02
Tetryl	57	0	1	2%	8.79E-02	1.59E-01	2.20E-01	FALSE	8.44E-02	8.44E-02
Metals										
Antimony	57	0	36	63%	4.51E+01	2.55E+02	1.93E+03	FALSE	5.12E+01	5.12E+01
Barium	57	0	56	98%	4.28E+02	1.39E+03	9.34E+03	FALSE	3.66E+02	3.66E+02
Copper	57	0	57	100%	8.88E+02	5.01E+03	3.79E+04	FALSE	5.24E+02	5.24E+02
Lead	57	0	57	100%	4.03E+03	1.90E+04	1.40E+05	FALSE	7.14E+03	7.14E+03
Mercury	57	0	45	79%	6.44E-01	1.64E+00	1.14E+01	FALSE	1.27E+00	1.27E+00
Selenium	57	0	31	54%	5.57E-01	4.51E-01	1.60E+00	TRUE	6.57E-01	6.57E-01
Thallium	57	0	17	30%	1.57E+00	6.13E+00	1.66E+01	FALSE	1.32E+00	1.32E+00
Zinc	57	0	57	100%	4.75E+02	1.93E+03	1.46E+04	FALSE	3.52E+02	3.52E+02
Herbicides										
2,4,5-T	16	0	2	13%	3.43E-03	1.71E-03	8.30E-03	FALSE	4.03E-03	4.03E-03
MCPP	16	0	1	6%	3.64E+00	3.30E+00	1.60E+01	FALSE	4.33E+00	4.33E+00

* Refer to text for a detailed discussion of EPC determination.

** 2,4-Dinitrotoluene and 2,6-Dinitrotoluene were analyzed for as semivolatile organics and nitroaromatics. The method yielding the higher EPC was used in the risk assessment.

TABLE 6-3D

Solids Exposure Point Concentration Summary

SEAD 16 - Remedial Investigation
Seneca Army Depot Activity

Analyte	No. of Valid Analyses	No. of Rejected SQLs	No. of Hits	Frequency (%)	Mean (mg/kg)	Standard Deviation (mg/kg)	Max Hit (mg/kg)	Normal?	95% UCL of Mean (mg/kg)	Exposure Point Concentration (EPC)* (mg/kg)
Volatile Organics										
1,1,1-Trichloroethane	6	4	1	17%	5.67E-03	6.83E-04	7.00E-03	FALSE	6.27E-03	6.27E-03
Methylene chloride	6	4	1	17%	5.67E-03	6.83E-04	7.00E-03	FALSE	6.27E-03	6.27E-03
Toluene	10	0	1	10%	9.15E-03	4.86E-03	2.00E-02	FALSE	1.31E-02	1.31E-02
Trichloroethene	10	0	1	10%	8.45E-03	3.41E-03	1.30E-02	FALSE	1.13E-02	1.13E-02
Semivolatile Organics										
2,4-Dinitrotoluene**	7	3	3	43%	4.29E+02	1.13E+03	3.00E+03	FALSE	2.89E+10	3.00E+03
2,6-Dinitrotoluene**	6	4	2	33%	1.25E+01	3.01E+01	7.40E+01	FALSE	3.45E+05	7.40E+01
2-Methylnaphthalene	8	2	6	75%	2.49E+00	6.67E+00	1.90E+01	FALSE	6.03E+02	1.90E+01
Acenaphthene	7	3	3	43%	8.48E-01	1.62E+00	4.50E+00	FALSE	3.18E+01	4.50E+00
Anthracene	7	3	4	57%	6.11E-01	1.03E+00	2.90E+00	FALSE	6.58E+01	2.90E+00
Benzo[a]anthracene	9	1	8	89%	4.05E-01	5.45E-01	1.60E+00	FALSE	3.74E+00	1.60E+00
Benzo[a]pyrene	10	0	9	90%	2.53E+01	7.90E+01	1.50E+00	FALSE	6.39E+03	1.50E+00
Benzo[b]fluoranthene	10	0	9	90%	2.53E+01	7.89E+01	1.60E+00	FALSE	2.90E+03	1.60E+00
Benzo[ghi]perylene	8	2	5	63%	2.71E-01	2.64E-01	8.70E-01	FALSE	8.05E-01	8.05E-01
Benzo[k]fluoranthene	9	1	8	89%	4.01E-01	5.11E-01	1.60E+00	FALSE	2.78E+00	1.60E+00
Butylbenzylphthalate	6	4	2	33%	9.13E+00	2.20E+01	5.40E+01	FALSE	4.56E+05	5.40E+01
Carbazole	7	3	4	57%	2.43E-01	2.65E-01	7.40E-01	TRUE	4.33E-01	4.33E-01
Chrysene	10	0	9	90%	2.55E+01	7.89E+01	1.90E+00	FALSE	2.64E+03	1.90E+00
Di-n-butylphthalate	7	3	3	43%	1.36E+02	3.59E+02	9.50E+02	FALSE	3.62E+08	9.50E+02
Dibenz[a,h]anthracene	7	3	2	29%	2.55E-01	1.59E-01	5.00E-01	TRUE	3.69E-01	3.69E-01
Dibenzofuran	8	2	4	50%	3.79E-01	4.75E-01	1.50E+00	FALSE	4.20E+00	1.50E+00
Diethyl phthalate	7	3	1	14%	2.80E-01	1.40E-01	5.30E-01	TRUE	3.80E-01	3.80E-01
Fluoranthene	10	0	9	90%	2.59E+01	7.87E+01	3.90E+00	FALSE	2.54E+03	3.90E+00
Fluorene	7	3	3	43%	1.08E+00	2.22E+00	6.10E+00	FALSE	5.13E+01	6.10E+00
Indeno[1,2,3-cd]pyrene	8	2	5	63%	2.14E-01	1.57E-01	4.50E-01	TRUE	3.17E-01	3.17E-01
N-Nitrosodiphenylamine	6	4	2	33%	3.36E+01	8.15E+01	2.00E+02	FALSE	3.06E+07	2.00E+02
Naphthalene	8	2	4	50%	3.93E-01	5.10E-01	1.60E+00	FALSE	5.50E+00	1.60E+00
Pentachlorophenol	5	5	1	20%	3.94E-01	9.86E-02	2.20E-01	FALSE	5.82E-01	2.20E-01
Phenanthrene	10	0	9	90%	2.78E+01	7.84E+01	2.20E+01	FALSE	2.82E+04	2.20E+01
Phenol	6	4	3	50%	6.30E+00	1.50E+01	3.70E+01	FALSE	5.40E+04	3.70E+01
Pyrene	10	0	9	90%	2.60E+01	7.87E+01	5.00E+00	FALSE	3.30E+03	5.00E+00
bis(2-Ethylhexyl)phthalate	7	3	5	71%	1.09E+00	1.77E+00	5.00E+00	FALSE	2.95E+01	5.00E+00
Pesticides/PCBs										
4,4'-DDD	7	3	3	43%	8.53E-03	1.18E-02	3.50E-02	FALSE	3.01E-02	3.01E-02
4,4'-DDE	10	0	9	90%	1.66E-01	2.55E-01	7.50E-01	FALSE	3.68E+00	7.50E-01
4,4'-DDT	10	0	10	100%	3.06E-01	3.70E-01	9.40E-01	FALSE	2.49E+01	9.40E-01
Aroclor-1254	8	2	6	75%	2.67E-01	4.71E-01	1.40E+00	FALSE	3.13E+00	1.40E+00
Aroclor-1260	9	1	6	67%	1.36E-01	1.92E-01	6.30E-01	FALSE	4.51E-01	4.51E-01
Dieldrin	8	2	2	25%	6.76E-03	8.70E-03	2.80E-02	FALSE	1.82E-02	1.82E-02
Endosulfan I	8	2	2	25%	4.44E-03	7.16E-03	2.20E-02	FALSE	1.78E-02	1.78E-02
Endosulfan II	7	3	3	43%	3.80E-03	1.67E-03	5.70E-03	TRUE	4.99E-03	4.99E-03
Endrin	7	3	1	14%	4.04E-03	2.77E-03	9.20E-03	TRUE	6.02E-03	6.02E-03
Heptachlorepoxide	7	3	1	14%	1.79E-03	9.15E-04	2.60E-03	TRUE	2.45E-03	2.45E-03
alpha-BHC	7	3	1	14%	1.99E-03	1.15E-03	3.70E-03	TRUE	2.82E-03	2.82E-03
alpha-Chlordane	9	1	7	78%	8.68E-03	1.48E-02	4.70E-02	FALSE	4.07E-02	4.07E-02
gamma-BHC/Lindane	6	4	1	17%	1.51E-03	6.74E-04	9.30E-04	TRUE	2.05E-03	9.30E-04
gamma-Chlordane	9	1	6	67%	7.22E-03	1.13E-02	3.60E-02	FALSE	3.27E-02	3.27E-02
Nitroaromatics										
2,4,6-Trinitrotoluene	8	3	1	13%	7.81E-02	3.71E-02	1.70E-01	FALSE	1.02E-01	1.02E-01
2,4-Dinitrotoluene**	11	0	8	73%	2.07E+03	5.72E+03	1.90E+04	FALSE	2.62E+11	1.90E+04
Metals										
Antimony	11	0	10	91%	3.11E+02	5.53E+02	1.56E+03	FALSE	1.29E+04	1.56E+03
Arsenic	11	0	11	100%	1.22E+01	1.37E+01	4.73E+01	FALSE	3.73E+01	3.73E+01
Barium	11	0	11	100%	6.39E+03	1.22E+04	4.05E+04	FALSE	2.83E+05	4.05E+04
Cadmium	8	3	7	88%	3.26E+01	4.77E+01	1.27E+02	FALSE	7.16E+04	1.27E+02
Copper	11	0	11	100%	1.31E+04	2.56E+04	8.14E+04	FALSE	4.70E+06	8.14E+04
Cyanide	11	0	6	55%	4.10E+00	7.24E+00	2.42E+01	FALSE	2.75E+01	2.42E+01
Lead	11	0	11	100%	8.95E+04	1.95E+05	5.27E+05	FALSE	8.08E+07	5.27E+05
Mercury	11	0	9	82%	6.79E+00	1.30E+01	3.93E+01	FALSE	9.49E+02	3.93E+01
Selenium	9	2	7	78%	1.45E+00	1.72E+00	5.80E+00	FALSE	1.45E+01	5.80E+00
Silver	8	3	4	50%	5.21E+00	8.38E+00	2.27E+01	FALSE	4.40E+02	2.27E+01
Sodium	11	0	11	100%	1.30E+03	1.55E+03	3.69E+03	FALSE	1.32E+04	3.69E+03
Thallium	11	0	2	18%	4.51E-01	4.18E-01	1.40E+00	FALSE	8.97E-01	8.97E-01
Zinc	11	0	11	100%	9.74E+03	1.53E+04	4.26E+04	FALSE	4.68E+05	4.26E+04
Herbicides										
2,4,5-T	8	0	2	25%	4.91E-03	3.46E-03	1.30E-02	FALSE	8.01E-03	8.01E-03
2,4,5-TP/Silvex	8	0	1	13%	4.54E-03	1.94E-03	7.90E-03	TRUE	5.82E-03	5.82E-03
2,4-D	8	0	1	13%	5.14E-02	4.55E-02	1.60E-01	FALSE	9.29E-02	9.29E-02
2,4-DB	8	0	1	13%	5.18E-02	3.45E-02	1.30E-01	FALSE	8.65E-02	8.65E-02
Dichloroprop	8	0	1	13%	4.31E-02	1.57E-02	6.10E-02	TRUE	5.34E-02	5.34E-02
MCPA	8	0	1	13%	4.30E+00	1.55E+00	6.00E+00	FALSE	5.90E+00	5.90E+00
MCPP	8	0	1	13%	6.30E+00	6.49E+00	2.20E+01	FALSE	1.28E+01	1.28E+01

* Refer to text for a detailed discussion of EPC determination

** 2,4-Dinitrotoluene and 2,6-Dinitrotoluene were analyzed for as a semivolatile organic and a nitroaromatic. The method yielding the higher EPC was used in the risk assessment.

TABLE 6-3E

Surface Water Exposure Point Concentration Summary

SEAD 16 - Remedial Investigation
Seneca Army Depot Activity

Analyte	No. of Valid Analyses	No. of Rejected SQLs	No. of Hits	Frequency (%)	Mean (mg/L)	Standard Deviation (mg/L)	Max Hit (mg/L)	Normal?	95% UCL of Mean (mg/L)	Exposure Point Concentration (EPC)* (mg/L)
Semivolatile Organics										
Bis(2-Ethylhexyl)phthalate	12	0	3	25%	4.38E-03	1.33E-03	3.00E-03	FALSE	6.21E-03	3.00E-03
Di-n-butylphthalate	12	0	1	8%	4.67E-03	1.32E-03	5.00E-04	FALSE	8.38E-03	5.00E-04
Pentachlorophenol	12	0	3	25%	9.98E-03	4.94E-03	4.00E-03	FALSE	3.45E-02	4.00E-03
Metals										
Aluminum	10	2	2	20%	9.06E-02	8.60E-02	2.61E-01	TRUE	1.40E-01	1.40E-01
Antimony	12	0	10	83%	2.43E-02	3.55E-02	1.24E-01	FALSE	5.74E-02	5.74E-02
Arsenic	12	0	8	67%	2.82E-03	1.67E-03	5.70E-03	TRUE	3.68E-03	3.68E-03
Barium	12	0	12	100%	1.17E-01	7.67E-02	3.48E-01	FALSE	1.54E-01	1.54E-01
Cadmium	12	0	7	58%	6.62E-04	5.28E-04	2.00E-03	FALSE	1.39E-03	1.39E-03
Calcium	12	0	12	100%	7.18E+01	1.56E+01	8.99E+01	TRUE	7.99E+01	7.99E+01
Chromium	12	0	3	25%	1.12E-03	8.75E-04	3.00E-03	FALSE	1.90E-03	1.90E-03
Cobalt	12	0	2	17%	1.33E-03	1.17E-03	4.10E-03	FALSE	2.31E-03	2.31E-03
Copper	12	0	12	100%	6.12E-02	1.15E-01	4.24E-01	FALSE	1.12E-01	1.12E-01
Iron	12	0	10	83%	8.60E-01	1.30E+00	3.65E+00	FALSE	7.91E+00	3.65E+00
Lead	12	0	12	100%	1.16E-01	2.24E-01	8.13E-01	FALSE	5.32E-01	5.32E-01
Magnesium	12	0	12	100%	8.95E+00	2.30E+00	1.14E+01	TRUE	1.01E+01	1.01E+01
Manganese	12	0	12	100%	5.27E-02	7.58E-02	2.52E-01	FALSE	2.17E-01	2.17E-01
Mercury	12	0	3	25%	1.37E-04	2.44E-04	9.00E-04	FALSE	2.29E-04	2.29E-04
Nickel	12	0	7	58%	2.94E-03	1.83E-03	5.50E-03	TRUE	3.88E-03	3.88E-03
Potassium	12	0	12	100%	2.91E+00	9.95E-01	4.59E+00	TRUE	3.42E+00	3.42E+00
Selenium	12	0	4	33%	1.64E-03	1.08E-03	4.30E-03	FALSE	2.58E-03	2.58E-03
Silver	12	0	1	8%	1.15E-03	1.34E-03	5.20E-03	FALSE	1.70E-03	1.70E-03
Sodium	12	0	12	100%	5.47E+00	2.71E+00	9.22E+00	TRUE	6.87E+00	6.87E+00
Vanadium	12	0	7	58%	1.95E-03	1.71E-03	4.90E-03	FALSE	4.11E-03	4.11E-03
Zinc	12	0	12	100%	1.23E-01	1.06E-01	3.80E-01	FALSE	2.50E-01	2.50E-01

* Refer to text for detailed discussion of EPC determination.

TABLE 6-3F

Sediment Exposure Point Concentration Summary

SEAD 16 - Remedial Investigation
Seneca Army Depot Activity

Analyte	No. of Valid Analyses	No. of Rejected SQLs	No. of Hits	Frequency (%)	Mean (mg/kg)	Standard Deviation (mg/kg)	Max Hit (mg/kg)	Normal?	95% UCL of Mean (mg/kg)	Exposure Point Concentration (EPC)* (mg/kg)
Volatile Organics										
2-Butanone	10	0	1	10%	9.00E-03	2.00E-03	1.20E-02	TRUE	1.01E-02	1.01E-02
Acetone	10	0	5	50%	1.81E-02	1.01E-02	3.60E-02	TRUE	2.38E-02	2.38E-02
Semivolatile Organics										
2,4-Dinitrotoluene**	10	0	3	30%	8.24E-01	1.62E+00	5.40E+00	FALSE	3.04E+00	3.04E+00
2-Methylnaphthalene	10	0	2	20%	2.42E-01	1.20E-01	5.50E-02	TRUE	3.11E-01	5.50E-02
Acenaphthene	10	0	1	10%	2.67E-01	1.06E-01	3.20E-02	TRUE	3.28E-01	3.20E-02
Acenaphthylene	10	0	3	30%	2.04E-01	1.18E-01	5.40E-02	TRUE	2.71E-01	5.40E-02
Anthracene	10	0	4	40%	1.90E-01	1.07E-01	1.00E-01	TRUE	2.51E-01	1.00E-01
Benzo(a)anthracene	10	0	7	70%	2.48E-01	1.59E-01	5.70E-01	TRUE	3.39E-01	3.39E-01
Benzo(a)pyrene	10	0	6	60%	2.95E-01	1.50E-01	6.00E-01	TRUE	3.81E-01	3.81E-01
Benzo(b)fluoranthene	10	0	6	60%	4.19E-01	3.23E-01	1.20E+00	FALSE	7.43E-01	7.43E-01
Benzo(g,h,i)perylene	10	0	7	70%	2.52E-01	1.49E-01	5.30E-01	TRUE	3.37E-01	3.37E-01
Benzo(k)fluoranthene	10	0	6	60%	3.29E-01	1.99E-01	7.80E-01	TRUE	4.43E-01	4.43E-01
bis(2-Ethylhexyl)phthalate	10	0	7	70%	1.75E-01	9.69E-02	2.70E-01	TRUE	2.30E-01	2.30E-01
Carbazole	10	0	3	30%	2.17E-01	1.12E-01	1.10E-01	TRUE	2.82E-01	1.10E-01
Chrysene	10	0	7	70%	3.91E-01	3.34E-01	1.20E+00	FALSE	1.16E+00	1.16E+00
Di-n-butylphthalate	10	0	4	40%	2.47E-01	7.00E-02	2.50E-01	TRUE	2.87E-01	2.50E-01
Dibenz(a,h)anthracene	10	0	5	50%	1.91E-01	1.13E-01	1.70E-01	TRUE	2.56E-01	1.70E-01
Fluoranthene	10	0	8	80%	4.28E-01	4.54E-01	1.60E+00	FALSE	2.08E+00	1.60E+00
Indeno(1,2,3-cd)pyrene	10	0	7	70%	2.41E-01	1.43E-01	5.00E-01	TRUE	3.23E-01	3.23E-01
N-Nitrosodiphenylamine (1)	10	0	1	10%	3.13E-01	1.12E-01	6.00E-01	FALSE	3.81E-01	3.81E-01
Phenanthrene	10	0	8	80%	2.08E-01	1.41E-01	4.20E-01	TRUE	2.88E-01	2.88E-01
Pyrene	10	0	8	80%	4.26E-01	4.07E-01	1.40E+00	TRUE	6.60E-01	6.60E-01
Pesticides/PCBs										
4,4'-DDD	10	0	8	80%	9.36E-02	2.26E-01	7.30E-01	FALSE	2.48E+00	7.30E-01
4,4'-DDE	10	0	10	100%	1.13E-01	1.70E-01	5.70E-01	FALSE	1.36E+00	5.70E-01
4,4'-DDT	10	0	8	80%	6.72E-02	1.28E-01	4.20E-01	FALSE	1.83E+00	4.20E-01
alpha-Chlordane	10	0	3	30%	3.64E-03	4.04E-03	1.21E-02	FALSE	8.44E-03	8.44E-03
Aroclor-1254	10	0	7	70%	1.22E-01	1.97E-01	6.70E-01	FALSE	3.00E-01	3.00E-01
Aroclor-1260	10	0	5	50%	4.90E-02	3.35E-02	1.30E-01	FALSE	8.00E-02	8.00E-02
Endosulfan I	10	0	7	70%	7.42E-03	7.67E-03	2.60E-02	FALSE	2.59E-02	2.59E-02
Endosulfan II	10	0	2	20%	3.36E-03	1.36E-03	6.30E-03	FALSE	4.31E-03	4.31E-03
Endosulfan sulfate	10	0	2	20%	4.27E-03	4.93E-03	1.80E-02	FALSE	7.58E-03	7.58E-03
Endrin aldehyde	10	0	1	10%	2.93E-03	7.84E-04	3.20E-03	TRUE	3.38E-03	3.20E-03
Gamma-Chlordane	10	0	2	20%	1.85E-03	9.28E-04	3.80E-03	TRUE	2.38E-03	2.38E-03
Heptachlor epoxide	10	0	1	10%	1.60E-03	5.42E-04	2.80E-03	FALSE	1.96E-03	1.96E-03
Nitroaromatics										
2,4-Dinitrotoluene**	10	0	2	20%	1.58E-01	2.67E-01	9.10E-01	FALSE	3.13E-01	3.13E-01
Metals										
Aluminum	10	0	10	100%	1.39E+04	5.13E+03	2.29E+04	TRUE	1.69E+04	1.69E+04
Antimony	10	0	9	90%	1.33E+01	1.60E+01	5.03E+01	FALSE	1.15E+02	5.03E+01
Arsenic	10	0	10	100%	6.06E+00	2.32E+00	9.60E+00	TRUE	7.39E+00	7.39E+00
Barium	10	0	10	100%	6.05E+02	1.20E+03	3.98E+03	FALSE	2.53E+03	2.53E+03
Beryllium	10	0	10	100%	5.83E-01	1.96E-01	9.30E-01	TRUE	6.95E-01	6.95E-01
Cadmium	10	0	10	100%	1.54E+00	2.20E+00	7.60E+00	FALSE	4.55E+00	4.55E+00
Calcium	10	0	10	100%	3.79E+04	2.36E+04	7.57E+04	TRUE	5.14E+04	5.14E+04
Chromium	10	0	10	100%	2.82E+01	1.00E+01	4.35E+01	TRUE	3.39E+01	3.39E+01
Cobalt	10	0	10	100%	1.02E+01	2.94E+00	1.56E+01	TRUE	1.18E+01	1.18E+01
Copper	10	0	10	100%	1.95E+03	5.47E+03	1.75E+04	FALSE	1.40E+04	1.40E+04
Iron	10	0	10	100%	2.84E+04	9.48E+03	4.64E+04	TRUE	3.38E+04	3.38E+04
Lead	10	0	10	100%	1.46E+03	1.33E+03	4.48E+03	TRUE	2.22E+03	2.22E+03
Magnesium	10	0	10	100%	8.22E+03	3.39E+03	1.51E+04	TRUE	1.02E+04	1.02E+04
Manganese	10	0	10	100%	2.78E+02	9.20E+01	4.47E+02	TRUE	3.31E+02	3.31E+02
Mercury	10	0	10	100%	6.06E-01	8.85E-01	2.50E+00	FALSE	3.47E+00	2.50E+00
Nickel	10	0	10	100%	3.47E+01	9.88E+00	5.09E+01	TRUE	4.04E+01	4.04E+01
Potassium	10	0	10	100%	2.14E+03	8.50E+02	3.87E+03	TRUE	2.63E+03	2.63E+03
Selenium	10	0	2	20%	1.13E+00	1.36E+00	4.90E+00	FALSE	1.98E+00	1.98E+00
Silver	10	0	1	10%	2.23E-01	8.20E-02	3.50E-01	TRUE	2.69E-01	2.69E-01
Sodium	10	0	10	100%	2.54E+02	2.16E+02	7.82E+02	FALSE	4.73E+02	4.73E+02
Thallium	10	0	2	20%	7.12E-01	3.83E-01	1.60E+00	TRUE	9.31E-01	9.31E-01
Vanadium	10	0	10	100%	2.61E+01	9.27E+00	3.98E+01	TRUE	3.14E+01	3.14E+01
Zinc	10	0	10	100%	3.48E+02	2.68E+02	9.52E+02	TRUE	5.02E+02	5.02E+02

* Refer to text for detailed discussion of EPC determination.

** 2,4- Dinitrotoluene was analyzed for as a semivolatile organic and a nitroaromatic. The method yielding the higher EPC was used in the risk assessment.

TABLE 6-3G

Groundwater Exposure Point Concentration Summary

SEAD 16 - Remedial Investigation
Seneca Army Depot Activity

Analyte	No. of Valid Analyses	No. of Rejected SQLs	No. of Hits	Frequency (%)	Mean (mg/L)	Standard Deviation (mg/L)	Max Hit (mg/L)	Normal?	95% UCL of Mean (mg/L)	Exposure Point Concentration (EPC)* (mg/L)
Semivolatile Organics										
3-Nitroaniline	11	0	1	9%	1.37E-02	3.76E-03	2.50E-02	FALSE	1.54E-02	1.54E-02
4-Chloroaniline	11	0	1	9%	5.45E-03	1.51E-03	1.00E-02	FALSE	6.16E-03	6.16E-03
Benzo[ghi]perylene	11	0	1	9%	4.64E-03	1.21E-03	1.00E-03	FALSE	6.77E-03	1.00E-03
Dibenz[a,h]anthracene	11	0	1	9%	4.61E-03	1.30E-03	7.00E-04	FALSE	7.69E-03	7.00E-04
Indeno[1,2,3-cd]pyrene	11	0	1	9%	4.60E-03	1.33E-03	6.00E-04	FALSE	8.18E-03	6.00E-04
Nitroaromatics										
1,3-Dinitrobenzene	11	0	2	18%	2.94E-04	5.01E-01	1.80E-03	FALSE	4.71E-04	4.71E-04
2,4-Dinitrotoluene	11	0	1	9%	1.80E-04	1.66E-01	6.80E-04	FALSE	2.41E-04	2.41E-04
Metals										
Copper	9	2	6	67%	1.10E-02	1.81E-02	5.68E-02	FALSE	1.98E-01	5.68E-02
Lead	10	1	6	60%	6.41E-03	7.10E-03	2.41E-02	FALSE	4.02E-02	2.41E-02
Sodium	11	0	11	100%	8.67E+01	1.57E+02	4.09E+02	FALSE	4.80E+02	4.09E+02
Thallium	11	0	4	36%	4.07E-03	2.40E-03	9.20E-03	FALSE	6.14E-03	6.14E-03
Vanadium	11	0	4	36%	1.45E-03	1.16E-03	3.80E-03	FALSE	2.45E-03	2.45E-03

* Refer to text for a detailed discussion of EPC determination.

of analyses performed, the number of times detected, the frequency of detection, the mean and standard deviation of the sampled concentration, the maximum detected concentration, the result of the test for normality, and the 95 percent UCL of the mean of the sampled concentration (RME and the CT concentrations).

Table 6-4 provides a summary of all chemicals quantified in the human health risk assessment. This table lists the analytes found in each sampled medium, less the inorganic analytes found at background levels.

6.3 EXPOSURE ASSESSMENT

6.3.1 Overview and Characterization of Exposure Setting

The objective of the exposure assessment was to estimate the type and magnitude of exposures to the Chemicals of Potential Concern (COPC) that are present at, or migrating from, the site. This component of the risk assessment can be performed either qualitatively or quantitatively. Quantitative assessment is preferred when toxicity factors necessary to characterize a compound of concern are available.

The exposure assessment consists of three steps (USEPA, 1989a):

1) **Characterize Exposure Setting:** Contained within this step is general information concerning the physical characteristics of the site as it pertains to potential considerations affecting exposure. The physical setting involves climate, vegetation, soil characteristics, surface and groundwater hydrology. All potentially exposed populations and subpopulations therein (receptors) are assessed relative to their potential for exposure. Additionally, locations relative to the site along with the current and potential future land use of the site are considered. This step is a qualitative one aimed at providing a general site perspective and offering insight on the surrounding population.

2) **Identify Exposure Pathways:** All exposure pathways, ways in which receptors can be exposed to contaminants that originate from the source, are reviewed in this step. Chemical sources and mechanisms for release along with subsequent fate and

TABLE 6-4

List of Chemicals by Media Quantified in the Human Health Risk Assessment

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Analyte	Indoor Air	Ambient Air	Surface Soils	Total Soils	Zero to 4ft Soils	Surface Water	Sediment	Solids	Groundwater
Volatile Organics									
Trichloroethane, 1,1,1-								X	
Tetrachloroethane, 1,1,2,2-		X	X	X	X				
Butanone, 2-				X	X		X		
Acetone		X	X	X	X		X		
Benzene		X	X	X	X				
Carbon Disulfide		X	X	X	X				
Bromomethane									
Chloroform		X	X	X	X				
Chloromethane									
Methylene Chloride		X	X	X	X			X	
Toluene		X	X	X	X			X	
Trichloroethene								X	
Xylene (total)		X	X	X	X				
Semivolatile Organics									
Dinitrotoluene, 2,4-		X	X	X	X		X	X	X
Dinitrotoluene, 2,6-		X	X	X	X			X	
Methylnaphthalene, 2-	X	X	X	X	X		X	X	
Methylphenol, 2-			X	X	X				
Dichlorobenzidine, 3,3'-		X	X	X	X				
Nitroaniline, 3-		X	X	X	X				X
Acenaphthene	X	X	X	X	X		X	X	
Acenaphthylene		X	X	X	X		X		
Anthracene	X	X	X	X	X		X	X	
Benzoic Acid	X								
Benzo(a)anthracene		X	X	X	X		X	X	
Benzo(a)pyrene		X	X	X	X		X	X	
Benzo(b)fluoranthene		X	X	X	X		X	X	
Benzo(g,h,i)perylene		X	X	X	X		X	X	X
Benzo(k)fluoranthene		X	X	X	X		X	X	
Butylbenzylphthalate	X			X	X			X	
Carbazole		X	X	X	X		X	X	
4-Chloroaniline									X
Chrysene		X	X	X	X		X	X	
Di-n-butylphthalate	X	X	X	X	X	X	X	X	
Dibenz(a,h)anthracene		X	X	X	X		X	X	X
Dibenzofuran	X	X	X	X	X			X	
Diethylphthalate	X	X	X	X	X			X	
Fluoranthene		X	X	X	X		X	X	
Fluorene	X	X	X	X	X			X	
Indeno(1,2,3-cd)pyrene		X	X	X	X		X	X	X
N-Nitrosodiphenylamine		X	X	X	X		X	X	
Naphthalene	X	X	X	X	X			X	
Pentachlorophenol		X	X	X	X	X		X	
Phenanthrene	X	X	X	X	X		X	X	
Phenol	X							X	
Pyrene		X	X	X	X		X	X	
bis(2-Ethylhexyl)phthalate	X	X	X	X	X	X	X	X	

TABLE 6-4

List of Chemicals by Media Quantified in the Human Health Risk Assessment

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Analyte	Indoor Air	Ambient Air	Surface Soils	Total Soils	Zero to 4ft Soils	Surface Water	Sediment	Solids	Groundwater
Pesticides/PCBs									
DDD, 4,4'-		X	X	X	X		X	X	
DDE, 4,4'-		X	X	X	X		X	X	
DDT, 4,4'-		X	X	X	X		X	X	
Aldrin		X	X	X	X				
Aroclor-1254		X	X	X	X		X	X	
Aroclor-1260		X	X	X	X		X	X	
Dieldrin		X	X	X	X			X	
Endosulfan I		X	X	X	X		X	X	
Endosulfan II		X	X	X	X		X	X	
Endosulfan sulfate		X	X	X	X		X		
Endrin		X	X	X	X			X	
Endrin aldehyde		X	X	X	X		X		
Endrin ketone		X	X	X	X				
Heptachlor		X	X	X	X				
Heptachlor epoxide		X	X	X	X		X	X	
Toxaphene		X	X	X	X				
alpha-BHC								X	
alpha-Chlordane		X	X	X	X		X	X	
beta-BHC		X	X	X	X				
gamma-BHC		X	X	X	X			X	
gamma-Chlordane		X	X	X	X		X	X	
delta-BHC			X	X	X				
Nitroaromatics									-
1,3-Dinitrobenzene									X
2,4-Dinitrotoluene		X	X	X	X		X	X	X
2,6-Dinitrotoluene		X	X	X	X				
1,3,5-Trinitrobenzene									
2,4,6-Trinitrotoluene								X	
2-amino-4,6-Dinitrotoluene		X	X	X	X				
Tetryl		X	X	X	X				
Metals									
Aluminum	X					X	X		
Antimony		X	X	X	X	X	X	X	
Arsenic						X	X	X	
Barium	X	X	X	X	X	X	X	X	
Beryllium							X		
Cadmium						X	X	X	
Calcium						X	X		
Chromium						X	X		
Cobalt						X	X		
Copper	X	X	X	X	X	X	X	X	X
Cyanide								X	
Iron						X	X		
Lead	X	X	X	X	X	X	X	X	X
Magnesium						X	X		
Manganese	X					X	X		
Mercury	X	X	X	X	X	X	X	X	
Nickel						X	X		
Potassium						X	X		
Selenium	X	X	X	X	X	X	X	X	
Silver						X	X	X	
Sodium						X	X	X	X
Thallium		X	X	X	X	X	X	X	X
Vanadium						X	X		X
Zinc		X	X	X	X	X	X	X	
Herbicides									
2,4,5-T		X	X	X	X			X	
2,4,5-TP (Silvex)								X	
2,4-D								X	
2,4-DB								X	
Dichloroprop								X	
MCPA								X	
MCPP		X	X	X	X			X	

transport are investigated. Exposure points of human contact and exposure routes are discussed before quantifying the exposure pathways in step 3.

3). **Quantify Exposure:** In this final process, the exposure levels (COPC intakes or doses) are calculated for each exposure pathway and receptor. These calculations typically follow EPA guidance for assumptions of intake variables or exposure factors for each exposure pathway and EPA-recommended calculation methods.

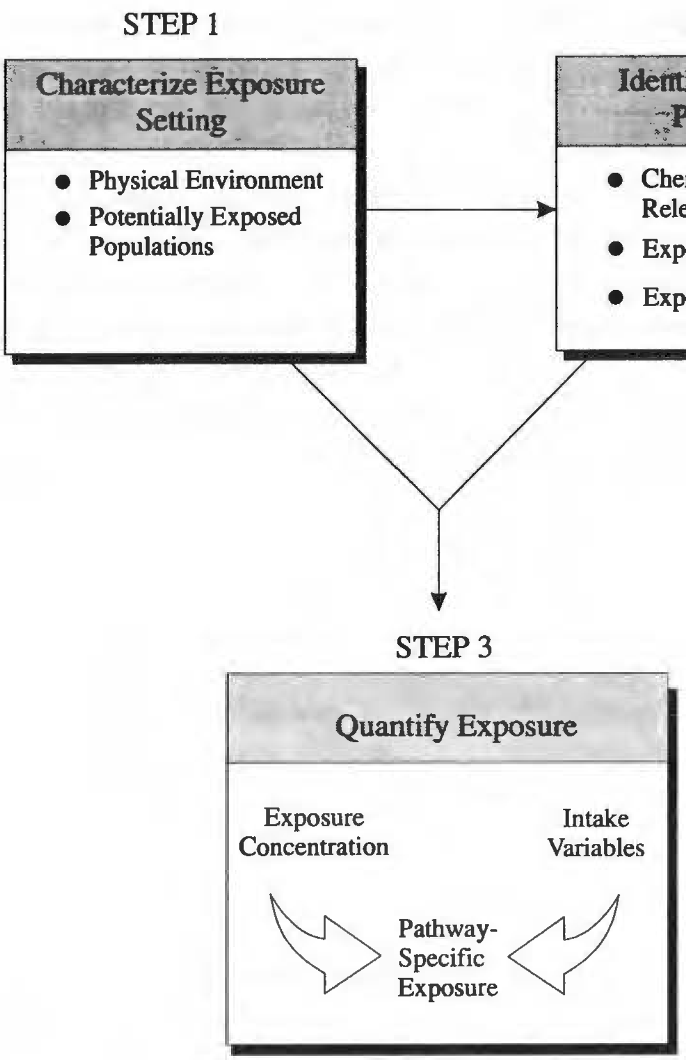
Figure 6-2 illustrates the exposure assessment process.

6.3.2 Physical Setting

SEDA lies on the western side of a series of north to south trending rock terraces which separate Cayuga Lake on the east and Seneca Lake on the west. The rock terraces range in elevation from 490 feet above MSL in northern Seneca County to as much as 1,600 feet above MSL at the southern end of the lakes. Elevations on SEDA range from 450 feet above MSL on the western boundary to 760 feet above MSL in the southeast corner. The Depot's land surface generally slopes to the west and north.

Land use is divided into three categories on SEDA. The Main Post accounts for 9,832 acres and consists of an exclusion area containing partially buried, reinforced concrete igloos, general storage magazines, and warehouses. The containment areas of the facility consist of the North and South Posts. The South Post is located in the southwest portion of the facility near Rte. 96 and is a developed area containing warehouses, administration buildings, quarters, and community services. The North Post, at the north end of the Main Post, includes troop housing, troop support and community services.

SEAD 16 is located in the east-central portion of SEDA and is situated on approximately 2.6-acres of fenced land. The entire site is enclosed by a chain-link fence with three gates and access to the area is restricted. The site is composed of grasslands to the north, east, and west and by a general storage area for empty boxes and wooden debris and an unpaved roadway to the south. Railroad tracks transect the site in a north-south direction. Vehicle access to Building S-311 is provided via an unpaved road.



Source: USEPA, 1989a

PARSONS
PARSONS ENGINEERING SCIENCE, INC.

CLIENT/PROJECT TITLE
SENECA ARMY DEPOT ACTIVITY
RI/FS
SEAD-16 ABANDONED DEACTIVATION FURNACE

DEPT. ENVIRONMENTAL ENGINEERING	DWG NO. 729895-01001

FIGURE 6-2
EXPOSURE ASSESSMENT
PROCESS

SCALE NA	DATE JANUARY 1997

R:\GRAPHICS\SENECA\16-17EPA.CDR

6.3.2.1 Climate

A cool climate exists in the locality of SEDA with temperatures ranging from an average of 23°F in January to 69°F in July. Marked temperature differences are found between daytime highs and nighttime lows during the summer and portions of the transitional seasons. Precipitation is well-distributed, averaging approximately 3 inches per month. The annual average snowfall is approximately 100 inches. Wind velocities are moderate, but during the winter months, there are numerous days with sufficient winds to cause blowing and drifting snow. Daily precipitation data measured at the Aurora Research Farm in Aurora, New York for the period (1957-1991) were obtained from the Northeast Regional Climate Center at Cornell University. The maximum 24-hour precipitation measured at this station during this period was 3.91 inches on September 26, 1975. Values of 35 inches mean annual pan evaporation and 28 inches for annual lake evaporation were reported. An independent value of 27 inches for mean annual evaporation from open water surfaces was estimated from an isoplethic figure found in "*Water Atlas of the United States*" (Water Information Center, 1973).

SEDA is located in the Genessee-Finger Lakes Air Quality Control Region (AQCR). The AQCR is designated as non-attainment for ozone and attainment or unclassified for all other criteria pollutants. Data for existing air quality in the immediate area surrounding SEDA, however, can not be obtained since the nearest state air quality stations are 40 to 50 miles away from the army depot.

6.3.2.2 Vegetation

The vegetative communities within the 0.5-mile study area are predominantly upland cover types unevenly distributed among the developed areas of the South Post. Cover types include mown lawns, old fields, shrublands, and deciduous forest. Unvegetated areas consist of open storage lots, railroads, paved roads, and buildings. Unvegetated corridors are maintained by herbicide application along the railroad tracks adjacent to the site.

On-site vegetation is sparse. Only a few specimens of common weeds have been able to establish root systems in the compacted fill soils at the site. No shrub or tree strata are present. Vegetation consists of grasses and early successional herbaceous species, primarily spotted knapweed (*Centaurea maculosa*), orchard grass (*Dactylis glomerata*), and various other grasses. These species occupy approximately 5 percent of the ground surface of the site.

The types and distribution of vegetative communities surrounding the site result from decades of human modification of the environment of South Post and the ammunition area (Main Post) (SEDA, 1992a, c). Mowing, drainage diversion, building construction, landscaping practices, forestry practices, plantations, and herbicide application all control the composition of vegetation surrounding the site.

A detailed discussion of the site vegetation is found in section 3.1.7.2.3 of the RI report.

6.3.2.3 Geologic Setting and Soil Classification

The site geology is characterized by gray Devonian shale with a thin weathered zone where it contacts the overlying mantle of Pleistocene till. This stratigraphy is consistent over the entire site. Artificial fill occurs above the till at locations around the buildings on the site.

The predominant surficial geologic unit present at the site is dense till. The till is distributed across the entire site and ranges in thickness from 0.5 feet to as much as 3.0 feet based upon refusal data collected during the ESI and RI, although the average thickness of the till on-site is only 1.7 feet. The till is generally characterized by brown to olive gray silt and clay, trace of fine sand with few fine to coarse gravel-sized inclusions of weathered shale. The general Unified Soil Classification System description of the till on-site is as follows: Clay-silt, brown to olive gray, slightly plastic, small percentage of fine to medium sand, small percentage of fine to coarse gravel-sized gray shale clasts, dense and mostly dry in place, till, (ML).

A zone of gray weathered shale of variable thickness was encountered below the till at all of the locations drilled on-site. This zone is characterized by fissile shale with a large amount of brown interstitial silt and clay. The thickness of the weathered shale on the site ranges between 0.2 feet to 2.7 feet, with an average thickness of 1.5 feet. Differential weathering through geologic time is likely responsible for the variable thickness. No outcrops of weathered or competent shale are exposed at SEAD-16. Gray competent shale was encountered between 3.1 feet and 6.0 feet below the land surface in the borings performed on the site.

A thin layer of fill covers many areas of the site. The fill becomes significantly thicker near the Abandoned Deactivation Furnace Building where it comprises the majority of the unconsolidated subsurface material. The fill near the building is believed to be associated with construction of Building S-311.

A detailed discussion of the Site Geology is provided in section 3.1.4 for the RI Report.

6.3.2.4 Surface Water Hydrology

Surface water flow from precipitation events is controlled by local topography, although there is little topographic relief on the site. In the grass-covered eastern portion of the site, surface water likely accumulates in local topographic low areas. Surface water run-off is directed off-site to the southeast and northwest by small drainage swales. In the paved western portion of the site, the asphalt is a relatively impermeable surface that results in an increased amount of surface water runoff in this portion of the site. Based on topographic expression, surface water flow on the asphalt is to the west. There are no sustained surface water bodies on-site.

Outside the chain link fence that surrounds SEAD-16, three sets of well-defined drainage ditches are potential flow pathways overland flow from the site. Two ditches parallel the railroad tracks southeast of the site. Two smaller ditches are present where these tracks exit the site to the northwest. Beyond the southern extent of the chain link fence, two additional drainage ditches drain due south.

6.3.2.5 Groundwater Hydrology

The hydrogeologic properties of the site were characterized in accordance with the investigation programs described in Section 2.0. The groundwater flow direction in the till/weathered shale aquifer on the site is not easily defined based on the groundwater elevation data available for the site.

A groundwater contour map was prepared using the August 27, 1996 data set. This map indicates that groundwater flow directions are to the north and northeast over most of the site, however, there is a southwesterly component of flow in the southwestern portion of the site. Groundwater elevations range from a high of 730.06 feet immediately southwest of Building S-311 to a low of 729.02 feet in the northeastern portion of the site. The maximum relief over the entire site is 1.04 feet. Saturated thicknesses for the aquifer at SEAD-16 were between 0.5 feet and 2.2 feet. In the northeastern portion of the site, the horizontal groundwater gradient was calculated to be 0.004 ft/ft, with the flow direction to the northeast. On another portion of the site, the gradient was calculated to be 0.01 ft/ft and groundwater flow is to the north.

A second groundwater contour map was constructed based on depth to water measurements made on December 6, 1996. This map indicates that groundwater flow directions are generally toward Building 366 in the central portion of the site at this time of year. These two flows are believed to coalesce near the central portion of the site and flow to the west following the regional slope of the land surface. Groundwater elevations range from a high of approximately 732 feet in the southwestern and northeastern portions of the site, and the lowest elevation is believed to occur near the Building 366. The maximum relief of the water table over the site is 2.2 feet. Saturated thicknesses for the aquifer at SEAD-16 were between 2.6 feet and 5.4 feet, values that are significantly greater than those measured in August 1996. The horizontal groundwater gradient was calculated to be 0.009 ft/ft in the northeastern portion of the site, and the flow direction was to the southwest. On another portion of the site, the gradient was calculated to be 0.01 ft/ft and groundwater flow was to the northeast.

There is no well defined direction of groundwater flow or groundwater gradient that is maintained throughout the year based on the groundwater topography maps discussed above for December 1996 and August 1996. Thus, velocities were calculated for both water table conditions. An average linear velocity of 0.93 feet/day (or 340 feet/year) at 20 percent effective porosity, and 1.2 feet/day (or 453 feet/year) at 15 percent effective porosity was determined for December. In August, two areas were measured, yielding groundwater velocities of 0.41 ft/day (or 151 ft/year) at 20 percent effective porosity, and 0.55 feet/day (or 201 feet/year) at 15 percent porosity was calculated for one area, and 1.0 feet/day (or 378 ft/year) at 20 percent, and 1.4 feet/day (or 504 feet/year) at 15 percent for the other.

It is important to note that the highly variable nature of the saturated thicknesses of the till/weathered shale aquifer may result in varying degrees of influence from the local bedrock topography on the direction and velocity of groundwater flow throughout the year. Therefore, the actual direction and distance of groundwater flow as indicated by the calculated velocities are likely to vary throughout the year.

A detailed discussion of the Groundwater Hydrology is provided in section 3.1.6 of the RI report.

6.3.3 Land Use and Potentially Exposed Populations

6.3.3.1 Current Land Use

The Former Deactivation Furnace is no longer active and *is in a centralized area of SEDA.* Offsite residents are not considered to be potential receptors due to the distances between the location of the offsite residences and SEAD 16. There are no drinking water supply wells at SEAD 16.

Access to the site is restricted by perimeter chain link fencing. This site has no actual site workers but is occasionally patrolled by site security personnel. As a result, it is unrealistic to assume that the workers from nearby sites will spend a significant amount of time on this site, and the most reasonable current on-site receptor was considered to be an infrequent Site Worker. The rationale of this decision is based on the site location relative to the majority of current site activity. The potential exposures occurring during onsite work have been evaluated in the risk assessment.

6.3.3.2 Potential Future Land Use

EPA guidance for determining future land uses recommends that, if available, master plans, which include future land uses, Bureau of Census projections and established land use trends in the general area should be utilized to establish future land use trends.

In July 1995, the Base Realignment and Closure Act (BRAC) Commission voted to recommend closure of SEDA. Congress approved the recommendation, which became public law on October 1, 1995. According to BRAC regulations, future uses of the site will be determined by the Army.

In accordance with BRAC regulations, the Army will notify all appropriate regulatory agencies and will perform any additional investigations and remedial actions to assure that any changes in the intended use of the sites is protective of human health and the environment in accordance with CERCLA. Also, Army regulations (Regulation 200-1, paragraph 12-5, Real Property Transactions), requires that Army to perform an Environmental Baseline Study (EBS) prior to a transfer of Army property. The EBS is an inventory and a comprehensive evaluation of the existing environmental conditions and consists of scope definition, survey, sampling, investigative and risk assessment.

As part of the 1995 Base Realignment and Closure (BRAC) process, a Land Redevelopment Authority comprised of representatives of the local public, was established. This group commissioned a study to recommend future uses for the Seneca Army Depot. The Land Reuse Plan which was produced designated various uses for different parcels of SEDA ranging from conservation/recreation to institutional, industrial and residential. The area which contains SEAD 16 was designated "Office/Planned Industrial Development".

In this human health assessment the future land use of SEAD 16 was considered to be industrial/commercial. Although the risk due to future land uses will be calculated in this BRA, the decision to perform a remedial action will be based upon the anticipated future land use. At such time that the property is intended to be transferred in accordance with CERCLA, the Army will notify all appropriate regulatory agencies and will perform any additional investigations and remedial actions to assure that the change in the intended land use is protective of human health and the environment.

6.3.3.3 Potentially Exposed Populations

For purposes of this baseline risk assessment, six types of potentially exposed populations were considered. Under the current land-use scenario, there is one single exposed population: site workers. The future land-use scenario assumes that SEAD 16 is used by a new industrial or commercial business. In this scenario, there are five (5) exposed populations:

1) Industrial workers who work in the existing building at SEAD 16;
2) Construction workers who work for a short term onsite;
3) A trespasser, presumed to be an adolescent age 13 to 18, who occasionally visits the property near the new commercial development;
4) Children who attend an on-site day care center (not located in the existing building); and
5) Adult workers at an on-site day care center.

The industrial worker and adult day care center worker are assumed to work 40 hours/week, 50 weeks a year at the new facility. The reasonable maximum exposure (RME) for the worker is based on 25 years of continuous employment at the site. The more typical or central tendency exposure (CT) is based on 7 years of employment.

The construction worker is assumed to work at the site for one year for both the RME and CT cases.

The child trespasser is assumed to occasionally visit the site over 5 years for the RME and just one year for the CT.

The day care center child is assumed to attend the center for six years, 60 hours/week (5 days week 12 hours/day) for 50 weeks a year under the RME scenario. The CT exposure is based on 10 hour days, 48 weeks/year for 3 years.

6.3.4 Identification of Exposure Pathways

Exposures are estimated only for plausible completed exposure pathways. A completed exposure pathway has the following four elements:

- a source and mechanism for chemical release,
- an environmental transport medium,
- an exposure point, and
- a human receptor and a feasible route of exposure at the exposure point.

A pathway cannot be completed unless each of these elements is present. The sources and mechanisms for release of chemicals and the environmental transport mediums are described in Section 5, Contaminant Fate and Transport.

6.3.4.1 Sources and Receiving Media

The contaminant source areas for this assessment of SEAD 16 consist of the Former Deactivation Furnace Building and the remaining area as defined by the SEAD boundaries. As discussed previously, these are areas where activities occurred in the past and where RI data have shown elevated levels of chemicals in the environment. As evidenced by the RI data, these source areas have since spread to include contaminated surface and subsurface soil, surface water and sediment. Surface soil in SEAD 16 and surface dust within the Deactivation Furnace Building appear to be the most significant source areas, as shown by the data.

6.3.4.2 Fate and Transport

The environmental fate associated with COPCs found at SEAD 16 is discussed in detail in Section 5. Dispersion and deposition of COPCs (indoors and outdoors) were the principal transport mechanisms resulting in current conditions at the site.

6.3.4.2.1 Volatile Organics

A relatively small number of volatile organic compounds (VOCs) were detected in soil, sediment and indoor solids at SEAD 16. VOCs were detected infrequently and in low concentrations. Because of this low prevalence and concentrations, direct volatilization of VOCs was not considered significant in this assessment.

6.3.4.2.2 Semi-Volatile Organics

The principal semi-volatile compounds found in SEAD 16 are PAHs and PCBs. Generally, these constituents are relatively persistent and immobile in the environment. This was verified by the RI sampling programs, which measured elevated concentrations of these constituents in the soil, but not in the groundwater.

6.3.4.2.3 Metals

The behavior of metals in soil is unlike organic compounds in many aspects. For example, volatilization of metals from soil is not considered a realistic mechanism for pollutant migration and was not considered. However, leaching and sorption were considered in the fate and transport evaluation. Leaching of metals from soil is controlled by numerous factors. Most importantly is its chemical form (base metal or cation) in the soil. The leaching of metals from soils is substantial if the metal exists as a soluble salt. Upon contact with surface water or precipitation, the metals, either as metal oxides or metal salts, can be solubilized, eventually leaching to the groundwater. In general, elevated concentrations of metals were not measured in the on-site monitoring wells.

6.3.4.3 Exposure Routes

Exposure routes are the means by which a human potentially contacts COPCs. Not all exposure routes will exist at every site. In general, these include inhalation, ingestion and dermal contact. Exposure pathways that will be evaluated at SEAD 16 are discussed below.

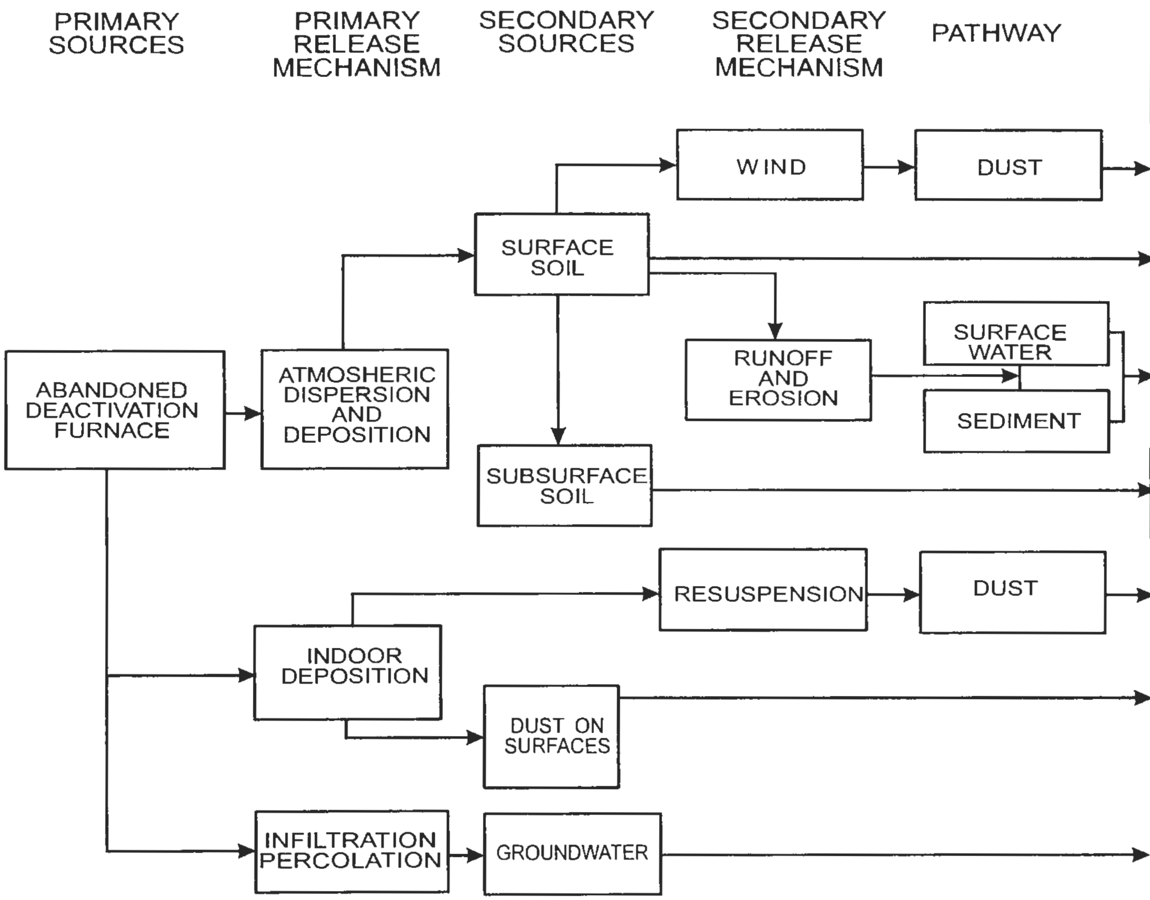
6.3.4.4 Exposure Points

The exposure point is the point of potential human contact with a chemical, either directly at its source or via a transport medium. The exposure points that may exist at SEAD 16 are:

- Indoor air inside the Deactivation Furnace Building: exposure to future workers.
- Indoor surface dust: exposure to future workers by direct contact.
- Small surface water/sediment areas: exposure to future trespassers by wading.
- Ambient air containing suspended soil particles: exposure to current site workers, future workers, construction workers, trespassers and day care receptors.
- Surface soils: exposure to all receptors by direct contact (ingestion and dermal).
- Subsurface soils: exposure to future construction workers by direct contact.
- Groundwater: exposure to future workers and day care receptors by ingestion.

6.3.4.5 Integration of Exposure Pathways

In this section, the final assembly of the components required to accurately construct an exposure pathway is performed. As described earlier the proper framework of an exposure pathway involves a source, transport medium, exposure point, and an exposure route. The pertinent exposure pathways for SEAD 16 are summarized in Figure 6-3. According to the RAGS (USEPA, 1989a), a pathway is considered incomplete if one or more of these components is not present with the exception of the transport medium, which may be absent in the case of direct exposures. Hence, the conclusion, if there is not a complete pathway, there can be no risk resulting from that theoretical pathway. For the purposes of this baseline risk assessment (BRA), current and future human exposure pathways have been identified as potential pathways which meet the criteria for an exposure pathway (exposure to surface water and sediment are counted separately).



EXPOSURE ROUTE	RECEPTOR HUMAN CURRENT SITE WORKERS	FUTURE INDUSTRIAL WORKER	FUTURE CONSTRUCTION WORKER	FUTURE TRESSPASSER	FUTURE DAY CARE CENTER CHILD	FUTURE DAY CARE CENTER WORKER
INHALATION	●	NA	●	●	●	●
INGESTION	●	NA	●	●	●	●
DERMAL CONTACT	●	NA	●	●	●	●
INGESTION	NA	NA	NA	●	NA	NA
DERMAL CONTACT	NA	NA	NA	●	NA	NA
INGESTION	NA	NA	●	NA	NA	NA
DERMAL CONTACT	NA	NA	●	NA	NA	NA
INHALATION	NA	●	NA	NA	NA	NA
INGESTION	NA	●	NA	NA	NA	NA
DERMAL CONTACT	NA	●	NA	NA	NA	NA
INGESTION	NA	●	NA	NA	●	●

● PATHWAY CONSIDERED TO POSE POTENTIAL RISK

NA NOT APPLICABLE RECEPTOR

PARSONS

PARSONS ENGINEERING SCIENCE, INC.

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT ACTIVITY
RI/FS
SEAD-16 FORMER DEACTIVATION FURNACE

DEPT. ENVIRONMENTAL ENGINEERING

DWG NO 729895-01002

FIGURE 6-3
EXPOSURE PATHWAY SUMMARY

SCALE NA

DATE MARCH 1998

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For the current site worker three exposure pathways are quantified. These are ingestion of surface soils, dermal contact to surface soils, and inhalation of particulates in ambient air. For the future trespasser the following pathways are quantified: ingestion and dermal contact with on-site surface water and sediment while wading; ingestion and dermal contact with site soils; and inhalation of particulates in ambient air. For the future construction worker, dermal contact with and ingestion of all soils, ingestion of groundwater and inhalation of particulates in ambient air are considered. For the future industrial worker, exposures are assumed to occur primarily inside the existing building from inhalation of indoor air, ingestion and dermal contact with indoor dust, and ingestion of groundwater. For the future day care center receptors (adult workers and children attendees) the following pathways are quantified: dermal contact with and ingestion of surface soils, ingestion of groundwater and inhalation of particulates in ambient air.

Other pathways were not quantified based on the following rationale:

1. Ingestion and dermal contact from surface water and sediment while swimming were considered to be an unrealistic current and future pathways of exposure because the depth of drainage ditches is at most only a few inches and would prevent a receptor from swimming.

2. Ingestion and dermal contact with soil by current offsite area residents was eliminated from the risk assessment based on the unlikely occurrence of a trespasser at SEAD 16. Security on the depot remains in place which prohibits unauthorized entrance to the grounds.

3. The most realistic current on-site exposure scenario is considered to be the site worker scenario. Because the assumptions are based on present data, it was determined that modeling a future site worker would yield no different risks than the current land use scenario.

6.3.4.6 Summary of Exposure Pathways to be Quantified

The pathways presented reflect the current onsite and the projected future onsite use of the Former Deactivation Furnace area. This section presents the rationale for including these exposure pathways in this risk assessment.

Inhalation of Particulate Matter in Ambient Air

The laboratory analysis of SEAD 16 surface and subsurface soils shows the presence of volatile organic compounds (VOCs), semi-volatile organic compounds and metals. Surface soil particles may become airborne via wind erosion, which in turn may be inhaled by individuals at the site. Construction workers may also be exposed to subsurface soil particles. Therefore, inhalation exposure to soil particulates in ambient air was assessed for current and future workers, future trespassers and future day care receptors.

Inhalation of Particulate Matter in Indoor Air

Site chemicals of concern were measured in ambient air samples and indoor air samples in the former deactivation furnace building at SEAD 16. These results indicate that resuspension of soil or indoor dust is a potential transport medium for onsite human exposure to COPCs. These air sampling results were used to estimate inhalation exposures for future industrial workers at the site.

Incidental Ingestion and Dermal Contact to On-Site Surface Soils

The laboratory analysis of SEAD 16 surface soils shows the presence of VOCs, semi-volatile organic compounds (including PAHs and pesticides) and metals. During the course of daily activities, an on-site worker or child trespasser could come into contact with these surface soils and involuntarily ingest and/or have their skin exposed to them. Therefore, exposure via dermal contact and soil ingestion was assessed for current infrequent site workers and future workers, trespassers and day care receptors.

Incidental Ingestion and Dermal Contact to On-Site Soils (Future)

The laboratory analysis of SEAD 16 all surface and subsurface soils shows the presence of semi-volatile organics, pesticides/PCBs, and metals. During the course of daily activities, an on-site construction worker will come into contact with these surface and subsurface soils during intrusive activities and may involuntarily ingest and have his/her skin exposed to them. Therefore, exposure via both dermal contact and soil ingestion was assessed for possible future construction worker.

Incidental Dermal Contact to Surface Water and Sediments (Future)

There are no permanent bodies of water at SEAD 16. However, pools of surface water form in drainage ditches at the site following precipitation. This surface water and the associated wet soil, or sediment, may contain chemicals found in the surface soils, since these ditches will collect runoff and soil eroded by the rainfall. While intentional adult contact with this surface water and sediment is unlikely, an adolescent trespasser could potentially wade in these ditches. Due to current site access restrictions, a trespasser could not contact these drainage ditches currently. Therefore, exposures to surface water and sediments via dermal contact were assessed for a future trespasser.

Incidental Ingestion of Sediment (Future)

When the drainage ditches are dry, there is potential for contact with the sediment contained in the ditches. While dermal contact with this sediment has been addressed above, there is also the potential that a future trespasser might ingest some of this sediment (similar to soil ingestion). Ingestion exposure to sediment would be limited, since the sediment would often be covered by surface water or snow. Exposure to sediment by ingestion was assessed quantitatively for a future trespasser.

Ingestion of Groundwater (Future)

The groundwater beneath the SEAD 16 is not currently used as a drinking water source for current site workers and there is no current on-site use of groundwater as a potable water source. Additionally, it is unlikely that a groundwater well would be installed for use by future construction workers. Therefore, ingestion of groundwater is not considered a completed pathway for each of these scenarios. For other future receptors, it was assumed that wells have been installed on-site for potable water. Therefore, this is considered a complete pathway and data from the on-site wells are used to calculated exposure concentrations.

6.3.5 Quantification of Exposure

In this section, each receptor's potential exposures to chemicals of potential concern (COPCs) is quantified for each of the exposure pathways described above. In each case, the exposures are calculated following methods recommended in EPA guidance documents, such as the Risk Assessment Guidance for Superfund (EPA 1989). These calculations generally involve two steps.

First, representative chemical concentrations in the environment, or exposure point concentrations (EPCs), are determined for each pathway and receptor. From these EPC values, the amount of chemical which an exposed person may take into his/her body is then calculated. This value is referred to as either the Human Intake or the Absorbed Dose, depending on the exposure route.

This section describes the exposure scenarios, exposure assumptions and exposure calculation methods used in this risk assessment. All calculations are shown in the tables included in Appendix I.

Risk assessment as a whole, and the exposure assessment step in particular, are designed to be health protective. The exposure calculations require estimates and assumptions about certain human exposure parameters, such as inhalation rates, ingestion rates, etc. Generally, values are selected which tend to overestimate exposure. USEPA (1993) recommends two types of exposure estimates be used for Superfund risk assessments: a reasonable maximum exposure (RME) and central tendency exposure (CT). The RME is defined as the highest exposure that could reasonably be expected to occur for a given exposure pathway at a site, and is intended to account for both uncertainty in the contaminant concentration and variability in the exposure parameters (such as exposure frequency or averaging time). The CT is also evaluated for comparison purposes and is generally based on mean exposure parameters. In accordance with this EPA guidance, both the CT and RME scenarios have been evaluated in this assessment.

Superfund risk assessments consider chronic exposures unless specific conditions warrant a short-term or an acute assessment. In this evaluation, long-term exposure to relatively low chemical concentrations is the greatest concern. Short-term (i.e., subchronic) and acute exposures were evaluated only for the construction worker, trespasser and day care child who have exposure durations ranging from 1 to 6 years.

Exposure-point concentrations (EPCs) were estimated for all pathways selected for quantitative evaluation. These concentrations are based on measured values (for soil, sediment, surface water, indoor air and groundwater) or on calculated estimates (for ambient air). Steady-state conditions were assumed. Therefore, current and future chemical concentrations were assumed to be identical. This assumption may tend to overestimate long-term exposure concentrations because chemical concentrations are likely to decrease over time from natural processes such as dispersion, attenuation, degradation and dilution.

Estimates of pathway-specific human intakes or absorbed doses for each chemical involve assumptions about patterns of human exposure to contaminated media. These assumptions are integrated with exposure-point concentrations to calculate intakes. Intakes or doses are normally expressed as the amount of chemical at the environment-human receptor exchange boundary in milligrams per kilogram of body weight per day (mg/kg-day), which represents an exposure normalized for body weight over time. The total exposure is divided by the time period of interest to obtain an average exposure. The averaging time is a function of the toxic endpoint: For noncarcinogenic effects, it is the exposure time (specific to the scenario being assessed) and for carcinogenic effects, it is lifetime (70 years).

6.3.5.1 Exposure Assumptions

An important aspect of exposure assessment is the determination of sets of assumptions regarding the manner in which receptors may be exposed to contaminants. USEPA guidance on exposure factors is extensive and was followed throughout this exposure assessment. Standard scenarios and EPA-recommended default assumptions were used where appropriate.

The exposure scenarios in this assessment involve the following receptors: current site worker, future industrial worker, future construction worker, and future child trespasser. The exposure assumptions for these scenarios are intended to approximate the frequency and duration of time and manner in which receptors are exposed to environmental media. For example, the commercial/industrial scenario is intended to approximate the exposure potential of those employed in the building at the site. The trespasser scenario is intended for use where occasional exposures are expected to occur, and in specifically limited fashion.

Two types of exposure estimates are presented in this risk assessment: RME and CT. Exposure assumptions specific to each type of estimate were used. Details of the exposure assumptions and parameters for each exposure scenario are shown in Table 6-5.

The primary sources for the RME and CT exposure factors are as follows:

- USEPA, 1988: Superfund Exposure Assessment Manual
- USEPA, 1989: Risk Assessment Guidance for Superfund, Volume I (RAGS)
- USEPA, 1991: Supplemental Guidance, Standard Default Exposure Factors
- SEPA, 1992: Dermal Exposure Assessment, Principles and Applications

Table 6-5

EXPOSURE FACTOR ASSUMPTIONS

SEAD 16-Remedial Investigation
Seneca Army Depot Activity

RECEPTOR	EXPOSURE ROUTE	RME/CT	PARAMETER	VALUE	UNITS	BASIS	SOURCE
CURRENT SITE WORKER	**Inhalation of Dust in Ambient Air** (Air EPC Calculated from Surface Soil Only)	RME & CT	Inhalation Rate	9.6	m3/day	Average inhalation rate for moderate activity is 1.2 m3/hr, 8 hr work day	USEPA, 1996
			Body Weight	70	kg	Standard reference weight for adult males	USEPA, 1991
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Exposure Frequency	20	days/yr	Assumed	BPJ
			Exposure Duration	25	years	Upper bound time for employment at a job	USEPA, 1991, 1993
			Averaging Time - Nc	9125	days	25 years	USEPA, 1989
		CT	Exposure Frequency	10	days/yr	Assumed	BPJ
			Exposure Duration	7	years	Mean time for employment at a job	USEPA, 1996
			Averaging Time - Nc	2555	days	7 years	USEPA, 1989
	Ingestion of Soil (Soil EPC Calculated from Surface Soil Only)	RME & CT	Body Weight	70	kg	Standard reference weight for adult males	USEPA, 1991
			Fraction Ingested	1	(unitless)	100% ingestion, conservative assumption	BPJ
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Ingestion Rate	100	mg soil/day	Upper bound worker exposure to dirt and dust.	USEPA, 1993
			Exposure Frequency	20	days/yr	Assumed	BPJ
			Exposure Duration	25	years	Upper bound time for employment at a job	USEPA, 1991, 1993
			Averaging Time - Nc	9125	days	25 years	USEPA, 1989
		CT	Ingestion Rate	50	mg soil/day	Average worker exposure to dirt and dust	USEPA, 1993
			Exposure Frequency	10	days/yr	Assumed	BPJ
			Exposure Duration	7	years	Mean time for employment at a job	USEPA, 1996
			Averaging Time - Nc	2555	days	7 years	USEPA, 1989
	Dermal Contact - Soil (Soil EPC Calculated from Surface Soil Only)	RME & CT	Body Weight	70	kg	Standard reference weight for adult males	USEPA, 1991
			Absorption Factor	Compound Specific			USEPA, 1992
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Skin Contact Surface Area	5800	cm2	Hands, legs, arms, neck and head exposed, 25% of upper bound body skin area of adult	USEPA, 1992
			Soil to Skin Adherence Factor	1	mg/cm2	Upper bound soil to skin adherence factor	USEPA, 1992
			Exposure Frequency	20	days/yr	Assumed	BPJ
			Exposure Duration	25	years	Upper bound time for employment at a job	USEPA, 1991, 1993
			Averaging Time - Nc	9125	days	25 years	USEPA, 1989
		CT	Skin Contact Surface Area	5000	cm2	Hands, legs, arms, neck and head exposed, 25% of average body skin area of adult	USEPA, 1992
			Soil to Skin Adherence Factor	0.2	mg/cm2	Average soil to skin adherence factor	USEPA, 1992
			Exposure Frequency	10	days/yr	Assumed	BPJ
			Exposure Duration	7	years	Mean time for employment at a job	USEPA, 1996
			Averaging Time - Nc	2555	days	7 years	USEPA, 1989

Table 6-5

EXPOSURE FACTOR ASSUMPTIONS

SEAD 16-Remedial Investigation
Seneca Army Depot Activity

RECEPTOR	EXPOSURE ROUTE	RME/CT	PARAMETER	VALUE	UNITS	BASIS	SOURCE
FUTURE INDUSTRIAL WORKER	**Inhalation of Dust in Indoor Air**	RME & CT	Inhalation Rate	9.6	m3/day	Average inhalation rate for moderate activity is 1.2 m3/hr, 8 hr work day	USEPA, 1996
			Body Weight	70	kg	Standard reference weight for adult males	USEPA, 1991
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Exposure Frequency	250	days/yr	Assumes works 5 days/wk and 10 days/yr vacation	USEPA, 1991
			Exposure Duration	25	years	Upper bound time for employment at a job	USEPA, 1991, 1993
			Averaging Time - Nc	9125	days	25 years	USEPA, 1989
		CT	Exposure Frequency	219	days/yr	Mean for adult workers	USEPA, 1993
			Exposure Duration	7	years	Mean time for employment at a job	USEPA, 1996
			Averaging Time - Nc	2555	days	7 years	USEPA, 1989
	Ingestion of Indoor Dust/Dirt	RME & CT	Body Weight	70	kg	Standard reference weight for adult males	USEPA, 1991
			Fraction Ingested	1	(unitless)	100% ingestion, conservative assumption	BPJ
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Ingestion Rate	100	mg solids/day	Upper bound worker exposure to dirt and dust	USEPA, 1993
			Exposure Frequency	250	days/yr	Assumes works 5 days/wk and 10 days/yr vacation	USEPA, 1991
			Exposure Duration	25	years	Upper bound time for employment at a job	USEPA, 1991, 1993
			Averaging Time - Nc	9125	days	25 years	USEPA, 1989
		CT	Ingestion Rate	50	mg solids/day	Average worker exposure to dirt and dust	USEPA, 1993
			Exposure Frequency	219	days/yr	Mean for adult workers	USEPA, 1993
			Exposure Duration	7	years	Mean time for employment at a job	USEPA, 1996
			Averaging Time - Nc	2555	days	7 years	USEPA, 1989
	Dermal Contact - Indoor Dust/Dirt	RME & CT	Body Weight	70	kg	Standard reference weight for adult males	USEPA, 1991
			Absorption Factor	Compound Specific			USEPA, 1992
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Skin Contact Surface Area	5800	cm2	Hands, legs, arms, neck and head exposed, 25% of upper bound body skin area of adult	USEPA, 1992
			Soil to Skin Adherence Factor	1	mg/cm2	Upper bound soil to skin adherence factor	USEPA, 1992
			Exposure Frequency	250	days/yr	Assumes works 5 days/wk and 10 days/yr vacation	USEPA, 1991
			Exposure Duration	25	years	Upper bound time for employment at a job	USEPA, 1991, 1993
			Averaging Time - Nc	9125	days	25 years	USEPA, 1989
		CT	Skin Contact Surface Area	5000	cm2	Hands, legs, arms, neck and head exposed, 25% of average body skin area of adult	USEPA, 1992
			Soil to Skin Adherence Factor	0.2	mg/cm2	Average soil to skin adherence factor	USEPA, 1992
			Exposure Frequency	219	days/yr	Mean for adult workers	USEPA, 1993
			Exposure Duration	7	years	Mean time for employment at a job	USEPA, 1996
			Averaging Time - Nc	2555	days	7 years	USEPA, 1989
	Ingestion of Groundwater	RME & CT	Body Weight	70	kg	Standard reference weight for adult males	USEPA, 1991
			Ingestion Rate	2	liters/day		USEPA, 1993
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Exposure Frequency	250	days/yr	Assumes works 5 days/wk and 10 days/yr vacation	USEPA, 1991
			Exposure Duration	25	years	Upper bound time for employment at a job	USEPA, 1991, 1993
			Averaging Time - Nc	9125	days	25 years	USEPA, 1989
		CT	Exposure Frequency	219	days/yr	Mean for adult workers	USEPA, 1993
			Exposure Duration	7	years	Mean time for employment at a job	USEPA, 1996
			Averaging Time - Nc	2555	days	7 years	USEPA, 1989

Table 6-5

EXPOSURE FACTOR ASSUMPTIONS

SEAD 16-Remedial Investigation
Seneca Army Depot Activity

RECEPTOR	EXPOSURE ROUTE	RME/CT	PARAMETER	VALUE	UNITS	BASIS	SOURCE
FUTURE CONSTRUCTION WORKER	**Inhalation of Dust in Ambient Air** (Air EPC Calculated from Surface and Subsurface Soils)	RME & CT	Inhalation Rate	10.4	m3/day	Average inhalation rate for outdoor worker is 1.3 m3/hr, 8 hr work day	USEPA, 1996
			Body Weight	70	kg	Standard reference weight for adult males	USEPA, 1991
			Exposure Duration	1	year	Upper bound time of employment for constr. worker	USEPA, 1991
			Averaging Time - Nc	365	days	1 year	USEPA, 1989
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Exposure Frequency	250	days/yr	Assumes works 5 days/wk and 10 days/yr vacation	USEPA, 1991
		CT	Exposure Frequency	219	days/yr	Mean for adult workers	USEPA, 1993
	Ingestion of Soil (Soil EPC Calculated from Surface and Subsurface Soils)	RME & CT	Body Weight	70	kg	Standard reference weight for adult males	USEPA, 1991
			Fraction Ingested	1	(unitless)	100% ingestion, conservative assumption	BPJ
			Exposure Duration	1	year	Upper bound time of employment for constr. worker	USEPA, 1991
			Averaging Time - Nc	365	days	1 year	USEPA, 1989
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Ingestion Rate	480	mg soil/day	Assumed IR for intensive construction work	USEPA, 1991, 1993
			Exposure Frequency	250	days/yr	Assumes works 5 days/wk and 10 days/yr vacation	USEPA, 1991
		CT	Ingestion Rate	100	mg soil/day	Assumed average IR for construction work	USEPA, 1993
			Exposure Frequency	219	days/yr	Mean for adult workers	USEPA, 1993
	Dermal Contact - Soil (Soil EPC Calculated from Surface and Subsurface Soils)	RME & CT	Body Weight	70	kg	Standard reference weight for adult males	USEPA, 1991
			Absorption Factor	Compound Specific			USEPA, 1992
			Exposure Duration	1	year	Upper bound time of employment for constr. worker	USEPA, 1991
			Averaging Time - Nc	365	days	1 year	USEPA, 1989
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Skin Contact Surface Area	5800	cm2	Hands, legs, arms, neck and head exposed, 25% of upper bound body skin area of adult	USEPA, 1992
			Soil to Skin Adherence Factor	1	mg/cm2	Upper bound soil to skin adherence factor	USEPA, 1992
			Exposure Frequency	250	days/yr	Assumes works 5 days/wk and 10 days/yr vacation	USEPA, 1991
		CT	Skin Contact Surface Area	5000	cm2	Hands, legs, arms, neck and head exposed, 25% of average body skin area of adult	USEPA, 1992
			Soil to Skin Adherence Factor	0.2	mg/cm2	Average soil to skin adherence factor	USEPA, 1992
			Exposure Frequency	219	days/yr	Mean for adult workers	USEPA, 1993

Table 6-5

EXPOSURE FACTOR ASSUMPTIONS

SEAD 16-Remedial Investigation
Seneca Army Depot Activity

RECEPTOR	EXPOSURE ROUTE	RME/CT	PARAMETER	VALUE	UNITS	BASIS	SOURCE
FUTURE TRESSPASSER CHILD	**Inhalation of Dust in Ambient Air** (Air EPC Calculated from Surface Soil Only)	RME & CT	Inhalation Rate	1.2	m3/day	Average inhalation rate for moderate activity is 1.2 m3/hr, exposure time of 1 hr/day	USEPA, 1996
			Body Weight	50	kg	mean weight for 13 year old	USEPA, 1996
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Exposure Frequency	50	days/yr	2 days/wk, 25 wk/yr	BPJ
			Exposure Duration	5	years	Assumed	BPJ
			Averaging Time - Nc	1825	days	5 years	USEPA, 1989
		CT	Exposure Frequency	25	days/yr	1 day/wk, 25 wk/yr	BPJ
			Exposure Duration	1	year	Assumed	BPJ
			Averaging Time - Nc	365	days	1 year	USEPA, 1989
	Ingestion of Soil (Soil EPC Calculated from Surface Soil Only)	RME & CT	Body Weight	50	kg	mean weight for 13 year old	USEPA, 1996
			Fraction Ingested	1	(unitless)	100% ingestion, conservative assumption	BPJ
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Ingestion Rate	200	mg soil/day	Maximum IR for a child	USEPA, 1993
			Exposure Frequency	50	days/yr	2 days/wk, 25 wk/yr	BPJ
			Exposure Duration	5	years	Assumed	BPJ
			Averaging Time - Nc	1825	days	5 years	USEPA, 1989
		CT	Ingestion Rate	100	mg soil/day	Average IR for a child	USEPA, 1993
			Exposure Frequency	25	days/yr	1 day/wk, 25 wk/yr	BPJ
			Exposure Duration	1	year	Assumed	BPJ
			Averaging Time - Nc	365	days	1 year	USEPA, 1989
	Dermal Contact - Soil (Soil EPC Calculated from Surface Soil Only)	RME & CT	Body Weight	50	kg	mean weight for 13 year old	USEPA, 1996
			Absorption Factor	Compound Specific			USEPA, 1992
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Skin Contact Surface Area	4625	cm2	Hands. legs, arms, neck and head exposed; 25% of upper bound body skin area of a 12-15 year old	USEPA, 1992
			Soil to Skin Adherence Factor	1	mg/cm2	Upper bound soil to skin adherence factor	USEPA, 1992
			Exposure Frequency	50	days/yr	2 days/wk, 25 wk/yr	BPJ
			Exposure Duration	5	years	Assumed	BPJ
			Averaging Time - Nc	1825	days	5 years	USEPA, 1989
		CT	Skin Contact Surface Area	3725	cm2	Hands. legs, arms, neck and head exposed; 25% of average body skin area of a 12-15 year old	USEPA, 1992
			Soil to Skin Adherence Factor	0.2	mg/cm2	Average soil to skin adherence factor	USEPA, 1992
			Exposure Frequency	25	days/yr	1 day/wk, 25 wk/yr	BPJ
			Exposure Duration	1	year	Assumed	BPJ
			Averaging Time - Nc	365	days	1 year	USEPA, 1989
	Dermal Contact - Surface Water	RME & CT	Body Weight	50	kg	mean weight for 13 year old	USEPA, 1996
			Absorption Factor	Compound Specific			USEPA, 1992
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Skin Contact Surface Area	4625	cm2	Feet and legs exposed; 25% of upper bound body skin area of a 12-15 year old	USEPA, 1992
			Exposure Frequency	25	days/yr	2 days/wk, 13 wk/yr	BPJ
			Exposure Duration	5	years	Assumed	BPJ
			Averaging Time - Nc	1825	days	5 years	USEPA, 1989
		CT	Skin Contact Surface Area	3725	cm2	Feet and legs exposed; 25% of average body skin area of a 12-15 year old	USEPA, 1992
			Exposure Frequency	13	days/yr	1 day/wk, 13 wk/yr	BPJ
			Exposure Duration	1	year	Assumed	BPJ
			Averaging Time - Nc	365	days	1 year	USEPA, 1989

Table 6-5

EXPOSURE FACTOR ASSUMPTIONS

SEAD 16-Remedial Investigation
Seneca Army Depot Activity

RECEPTOR	EXPOSURE ROUTE	RME/CT	PARAMETER	VALUE	UNITS	BASIS	SOURCE
FUTURE TRESSPASSER CHILD (continued)	**Dermal Contact - Sediment**	RME & CT	Body Weight	50	kg	mean weight for 13 year old	USEPA, 1996
			Absorption Factor	Compound Specific			USEPA, 1992
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Skin Contact Surface Area	4625	cm2	Feet and legs exposed; 25% of body skin area of a 12-15 year old	USEPA, 1992
			Soil to Skin Adherence Factor	1	mg/cm2	Upper bound soil to skin adherence factor	USEPA, 1992
			Exposure Frequency	25	days/yr	2 day/wk, 13 wk/yr	BPJ
			Exposure Duration	5	years	Assumed	BPJ
			Averaging Time - Nc	1825	days	5 years	USEPA, 1989
		CT	Skin Contact Surface Area	3725	cm2	Feet and legs exposed; 25% of body skin area of a 12-15 year old	USEPA, 1992
			Soil to Skin Adherence Factor	0.2	mg/cm2	Average soil to skin adherence factor	USEPA, 1992
			Exposure Frequency	13	days/yr	1 day/wk, 13 wk/yr	BPJ
			Exposure Duration	1	year	Assumed	BPJ
			Averaging Time - Nc	365	days	1 year	USEPA, 1989
	Ingestion - Sediment	RME & CT	Body Weight	50	kg	mean weight for 13 year old	USEPA, 1996
			Fraction Ingested	1	(unitless)	100% ingestion, conservative assumption	BPJ
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Ingestion Rate	200	mg/day	Maximum IR for a child	USEPA, 1993
			Exposure Frequency	25	days/yr	1 day/wk, 25 wk/yr	BPJ
			Exposure Duration	5	years	Assumed	BPJ
			Averaging Time - Nc	1825	days	5 years	USEPA, 1989
		CT	Ingestion Rate	100	mg/day	Average IR for a child	USEPA, 1993
			Exposure Frequency	13	days/yr	1 day/wk, 13 wk/yr	BPJ
			Exposure Duration	1	year	Assumed	BPJ
			Averaging Time - Nc	365	days	1 year	USEPA, 1989

Table 6-5

EXPOSURE FACTOR ASSUMPTIONS

SEAD 16-Remedial Investigation
Seneca Army Depot Activity

RECEPTOR	EXPOSURE ROUTE	RME/CT	PARAMETER	VALUE	UNITS	BASIS	SOURCE
FUTURE DAY CARE CENTER CHILD	**Inhalation of Dust in Ambient Air** (Air EPC Calculated from Surface Soil Only)	RME & CT	Inhalation Rate	4	m3/day	Average non-sleeping inhalation rate for 3-5 year olds is 0.4 m3/hr, exposure time 10 hr/day	USEPA, 1996
			Body Weight	15	kg	mean weight for 0-6 year olds	USEPA, 1993
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Exposure Frequency	250	days/yr	Assumes attends 5 days/wk and 10 days vacation	USEPA, 1991
			Exposure Duration	6	years	Assumes attends from 0-6 years old	BPJ
			Averaging Time - Nc	2190	days	6 years	USEPA, 1989
		CT	Exposure Frequency	219	days/yr	Average for occupational workers	USEPA, 1993
			Exposure Duration	3	years		BPJ
			Averaging Time - Nc	1095	days		BPJ
	Ingestion of Soil (Soil EPC Calculated from Surface Soil Only)	RME & CT	Body Weight	15	kg	mean weight for 0-6 year olds	USEPA, 1993
			Fraction Ingested	1	(unitless)	100% ingestion, conservative assumption	BPJ
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Ingestion Rate	200	mg soil/day	Maximum IR for a child	USEPA, 1993
			Exposure Frequency	250	days/yr	Assumes attends 5 days/wk and 10 days vacation	USEPA, 1991
			Exposure Duration	6	years	Assumes attends from 0-6 years old	BPJ
			Averaging Time - Nc	2190	days	6 years	USEPA, 1989
		CT	Ingestion Rate	100	mg soil/day	Average IR for a child	USEPA, 1993
			Exposure Frequency	219	days/yr	Average for occupational workers	USEPA, 1993
			Exposure Duration	3	years		BPJ
			Averaging Time - Nc	1095	days		BPJ
	Dermal Contact - Soil (Soil EPC Calculated from Surface Soil Only)	RME & CT	Body Weight	15	kg	mean weight for 0-6 year olds	USEPA, 1993
			Absorption Factor	Compound Specific			
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Skin Contact Surface Area	2190	cm2	Hands. legs, arms, neck and head exposed; 25% of upper bound body skin area of a 3-6 year old	USEPA, 1992
			Soil to Skin Adherence Factor	1	mg/cm2	Upper bound soil to skin adherence factor	USEPA, 1992
			Exposure Frequency	250	days/yr	Assumes attends 5 days/wk and 10 days vacation	USEPA, 1991
			Exposure Duration	6	years	Assumes attends from 0-6 years old	BPJ
			Averaging Time - Nc	2190	days	6 years	USEPA, 1989
		CT	Skin Contact Surface Area	1820	cm2	Hands. legs, arms, neck and head exposed; 25% of average body skin area of a 3-6 year old	USEPA, 1992
			Soil to Skin Adherence Factor	0.2	mg/cm2	Average soil to skin adherence factor	USEPA, 1992
			Exposure Frequency	219	days/yr	Average occupational workers	USEPA, 1993
			Exposure Duration	3	years		BPJ
			Averaging Time - Nc	1095	days		BPJ
	Ingestion of Groundwater	RME & CT	Body Weight	15	kg	mean weight for 0-6 year olds	USEPA, 1993
			Ingestion Rate	1	liters/day		USEPA, 1996
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Exposure Frequency	250	days/yr	Assumes attends 5 days/wk and 10 days vacation	USEPA, 1991
			Exposure Duration	6	years	Assumes attends from 0-6 years old	BPJ
			Averaging Time - Nc	2190	days	6 years	USEPA, 1989
		CT	Exposure Frequency	219	days/yr	Average occupational workers	USEPA, 1993
			Exposure Duration	3	years		BPJ
			Averaging Time - Nc	1095	days		BPJ

Table 6-5

EXPOSURE FACTOR ASSUMPTIONS

SEAD 16-Remedial Investigation
Seneca Army Depot Activity

RECEPTOR	EXPOSURE ROUTE	RME/CT	PARAMETER	VALUE	UNITS	BASIS	SOURCE
FUTURE DAY CARE CENTER WORKER	**Inhalation of Dust in Ambient Air** (Air EPC Calculated from Surface Soil Only)	RME & CT	Inhalation Rate	8	m3/day	Average inhalation rate for light activity is 1 m3/hr, 8 hr work day	USEPA, 1996
			Body Weight	70	kg	Standard reference weight for adult males	USEPA, 1991
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Exposure Frequency	250	days/yr	Assumes works 5 days/wk and 10 days/yr vacation	USEPA, 1991
			Exposure Duration	25	years	Upper bound time for employnent at a job	USEPA, 1991, 1993
			Averaging Time - Nc	9125	days	25 years	USEPA, 1989
		CT	Exposure Frequency	219	days/yr	Mean for adult workers	USEPA, 1993
			Exposure Duration	7	years	Mean time for employment at a job	USEPA, 1996
			Averaging Time - Nc	2555	days	7 years	USEPA, 1989
	Ingestion of Soil (Soil EPC Calculated from Surface Soil Only)	RME & CT	Body Weight	70	kg	Standard reference weight for adult males	USEPA, 1991
			Fraction Ingested	1	(unitless)	100% ingestion, conservative assumption	BPJ
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Ingestion Rate	100	mg soil/day	Upper bound worker exposure to dirt and dust	USEPA, 1993
			Exposure Frequency	250	days/yr	Assumes works 5 days/wk and 10 days/yr vacation	USEPA, 1991
			Exposure Duration	25	years	Upper bound time for employment at a job	USEPA, 1991, 1993
			Averaging Time - Nc	9125	days	25 years	USEPA, 1989
		CT	Ingestion Rate	50	mg soil/day	Average worker exposure to dirt and dust	USEPA, 1993
			Exposure Frequency	219	days/yr	Mean for adult workers	USEPA, 1993
			Exposure Duration	7	years	Mean time for employment at a job	USEPA, 1996
			Averaging Time - Nc	2555	days	7 years	USEPA, 1989
	Dermal Contact - Soil (Soil EPC Calculated from Surface Soil Only)	RME & CT	Body Weight	70	kg	Standard reference weight for adult males	USEPA, 1991
			Absorption Factor	Compound Specific			USEPA, 1992
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Skin Contact Surface Area	5800	cm2	Hands, legs, arms, neck and head exposed, 25% of upper bound body skin area of adult	USEPA, 1992
			Soil to Skin Adherence Factor	1	mg/cm2	Upper bound soil to skin adherence factor	USEPA, 1992
			Exposure Frequency	250	days/yr	Assumes works 5 days/wk and 10 days/yr vacation	USEPA, 1991
			Exposure Duration	25	years	Upper bound time for employment at a job	USEPA, 1991, 1993
			Averaging Time - Nc	9125	days	25 years	USEPA, 1989
		CT	Skin Contact Surface Area	5000	cm2	Hands, legs, arms, neck and head exposed, 25% of average body skin area of adult	USEPA, 1992
			Soil to Skin Adherence Factor	0.2	mg/cm2	Average soil to skin adherence factor	USEPA, 1992
			Exposure Frequency	219	days/yr	Mean for adult workers	USEPA, 1993
			Exposure Duration	7	years	Mean time for employment at a job	USEPA, 1996
			Averaging Time - Nc	2555	days	7 years	USEPA, 1989
	Ingestion of Groundwater	RME & CT	Body Weight	70	kg	Standard reference weight for adult males	USEPA, 1991
			Ingestion Rate	2	liters/day		USEPA, 1992
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Exposure Frequency	250	days/yr	Assumes works 5 days/wk and 10 days/yr vacation	USEPA, 1991
			Exposure Duration	25	years	Upper bound time for employment at a job	USEPA, 1991, 1993
			Averaging Time - Nc	9125	days	25 years	USEPA, 1989
		CT	Exposure Frequency	219	days/yr	Mean for adult workers	USEPA, 1993
			Exposure Duration	7	years	Mean time for employment at a job	USEPA, 1996
			Averaging Time - Nc	2555	days	7 years	USEPA, 1989

RME = Resonable Maximum Exposure
CT = Central Tendency
Car = Carcinogenic
Nc = Non-carcinogenic

Source References:
- USEPA, 1988: Superfund Exposure Assessment Manual
- USEPA, 1989: Risk Assessment Guidance for Superfund, Volume I (RAGS)
- USEPA, 1991: Supplemental Guidance, Standard Default Exposure Factors
- USEPA, 1992: Dermal Exposure Assessment, Principles and Applications
- USEPA, 1993: Superfund's Standard Default Exposure for the Central Tendency and Reasonable Maximum Exposure
- USEPA, 1996: Exposure Factors Handbook, Draft update to 1990 handbook

- USEPA, 1993: Superfund's Standard Default Exposure for the Central Tendency and Reasonable Maximum Exposure
- USEPA, 1996: Exposure Factors Handbook

In the following sections, the methods used to calculate exposures by each pathway are explained. Tables which show the human intake or absorbed dose values calculated for each exposure scenario are contained in Appendix I. These intakes and doses are used to assess overall carcinogenic and non-carcinogenic risk, as discussed later in the risk characterization section (Section 6.5).

6.3.5.2 Exposure Scenarios

The six exposure scenarios and their respective exposure assumptions in this assessment are described below.

Current Site Worker. Current workers at the site spend their time throughout the entire SEDA. Therefore, the current site worker is assumed to visit SEAD 16 infrequently. During these visits, this worker inhales the ambient air at SEAD 16 and may ingest or dermally contact the surface soil there. Based on professional judgment, it was assumed that the current site worker visits SEAD 16 on 20 days per year, as the reasonable maximum exposure (RME) and 10 days per year, as the central tendency (CT). All other exposure factors used in the exposure assessment were obtained from EPA guidance documents, as noted in Table 6-5.

Future Construction Worker. Future construction workers are assumed to spend one year working at SEAD 16, which is a typical duration for a significant construction project. These workers spend each working day at SEAD 16 (5 days/week for 50 weeks, RME; slightly less for the CT). During this time, this worker inhales the ambient air at SEAD 16 and may ingest or dermally contact the soil there. Since the construction worker may be digging onsite, the soil ingestion or dermal contact with both surface and subsurface soils was assumed. All other exposure factors used in the exposure assessment were obtained from EPA guidance documents, as noted in Table 6-5.

Future Industrial Worker. Future industrial workers are assumed to work inside the building at SEAD 16 which housed the former deactivation furnace. These workers spend each working day at SEAD 16 (5 days/week for 50 weeks, RME; slightly less for the CT). This exposure period lasts for an entire 25 year career (RME) or a more typical 7 year job span (CT). During this time, this worker inhales the indoor air inside the building at SEAD 16 and may ingest or dermally contact the surface dust or debris currently found there. This worker also drinks groundwater at the site. All other exposure factors used in the exposure assessment were obtained from EPA guidance documents, as noted in Table 6-5.

Future Adolescent Trespasser. Future public exposure to SEAD 16 may occur during infrequent visits to the site. There will be no residences at SEAD 16; however it is conceivable that people living at nearby residences could occasionally visit this area. This visitor, or trespasser, is assumed to be an adolescent. Based on professional judgment, it is assumed that the future trespasser visits SEAD 16 on 50 days per year, as the reasonable maximum exposure (RME) and 25 days per year, as the central tendency (CT). The rationale for this frequency is twice or once per week, for the RME and CT respectively, during the warmer months (25 weeks assumed). These visits continue for 5 years (RME) or just one year (CT). During these visits, this trespasser inhales the ambient air at SEAD 16 and may ingest or dermally contact the surface soil, standing surface water and sediment there. Several of these exposure pathways were considered possible during each visit: inhalation, ingestion and dermal contact with soil. Exposure by the remaining pathways was assumed to be less frequent. For example, contact with surface water requires standing water to be present (which occurs only after rainfall) and deliberate contact with this water. Accordingly, exposure via the surface water and sediment pathways was assumed to occur only during half of the site visits. Ingestion of sediment is assumed to occur when the drainage ditches are dry, when the sediment could potentially be ingested in the same manner as soil. This pathway is assumed to have the same exposure frequency (EF) and exposure duration (ED) used for the surface water pathway, since ingestion of dry sediment is expected to be about as infrequent as wading in the wet drainage ditches. All other exposure factors used in the exposure assessment were obtained from EPA guidance documents, as noted in Table 6-5.

Future Day Care Center Child. It is possible that a day care center could be established onsite as part of a future commercial/industrial enterprise. Future day care children are assumed to attend the center 5 days/week, 12 hours/day, 50 weeks/year for 6 years for the RME scenario. The CT scenario assumes day care center attendance for 5 days/week, 10 hours/day, 48 weeks/year for 3 years. During this time, the child inhales the ambient air, ingests groundwater, and ingests and dermally contacts surface soil.

Future Day Care Center Worker. The adult worker at the day care center has the same work schedule and exposure duration as the future industrial worker. Like the day care child, the day care center worker inhales the ambient air, ingests groundwater, and ingests and dermally contacts surface soil.

6.3.5.3 Inhalation of Particulate Matter in Ambient Air

This pathway consists of particulate matter (PM) being released from soils to the air and then being inhaled by current and future receptors. Ambient PM concentrations for a construction worker were estimated using an emission and dispersion model. PM concentrations for the site worker, future trespasser and day care receptors were based on existing site air measurements shown in Table 6-6.

Construction Worker

During construction activities, construction workers may be exposed to chemicals in site soils via inhalation. Construction activities, such as excavation, have the potential to create dust, or suspended particulate matter (PM), originating from the soils being removed. This dust would contain the chemicals present in the soil. Construction workers in the construction area would breathe this PM in the ambient air.

Air concentrations of site chemicals of concern were estimated for this exposure pathway using excavation models recommended in the USEPA's "Models for Estimating Air Emission Rates from Superfund Remedial Actions" (EPA 451/R-93-001).

Particulate emissions from soil excavation and loading into trucks are estimated with the following equation:

$$E = \frac{k\,(0.0016)(M)[U/2.2]^{1.3}}{[X/2]^{1.4}}$$

where:

E = emissions (g)
k = particle size multiplier (unitless)

TABLE 6-6

Suspended Particulate Concentrations Measured at SEDA

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

PARTICULATE DATA	SITE #1		SITE #2		SITE #3		SITE #4	
	TSP	PM 10	TSP	PM 10	TSP	PM 10	TSP	PM 10
Peak Concentration (ug/m3)	47 on 20 June 95	37 on 23 July 95	91 on 29 June 95	37 on 23 July 95	72 on 20 June 95	37 on 5 July 95	47 on 20 June 95	37 on 5 July 95
Arithmetic Mean (ug/m3)	26.7	16.9	37.7	16.6	28.5	16.4	27.6	15.8
Standard Deviation	8.4	21.4	16.0	21.1	17.7	23.0	19.7	23.0
Geometric Mean (ug/m3)	25.0	15.1	35.1	14.8	25.9	14.8	26.2	14.2
No. of 24-hr. Avgs. Above 150 ug/m3	0	0	0	0	0	0	0	0
Number of Valid Samples	30	29	22	32	31	29	31	31
Percent Data Recovery	93.8	90.6	68.8	100.0	96.9	90.6	96.9	96.9

Cumulative Summary for April 1, 1995 through July 31, 1995

0.0016 = empirical constant (g/kg)
M = mass of soil handled (kg)
U = mean wind speed (m/sec)
2.2 = empirical constant (m/sec)
X = percent moisture content (%)

The construction worker receptor is assumed to work at SEAD 16 for a one year period. To conservatively estimate potential particulate emissions from construction activities during this period, it was assumed that the area of SEAD 16 where metals were detected in the soils (an approximate 55,000 square foot area) is excavated to a depth of two meters over the course of one year. This results in the following mass of soil removed:

Mass = Area x Depth x Soil Bulk Density

= 5110 square meters x 2 meters x 1.5 g/cm^3 x 10^6 cm^3/m^3
= 1.53 x 10^{10} grams
= 1.53 x 10^7 kg

This mass of soil is assumed to be handled (i.e. excavated, dumped into piles or loaded into a truck) twice. Therefore, the effective mass (M) for the model is double the actual mass, or 3.07 x 10^7 kg.

Other parameter values for the model are as follows:

k = 0.35 for PM_{10} (USEPA 1993)
U = 4.4 m/sec, average wind speed for Syracuse, NY (USEPA 1985)
X = 10%, recommended default (USEPA 1993)

With these values for M, k, U and X, the emission rate (E) from excavation activities is 4447 grams of PM_{10} over the course of a year. This is equivalent to an average emission rate of 17.8 g/day, 2.22 g/hr or 0.62 mg/sec, assuming emission occur only during work days: 250 days/yr, 8hr/day.

Much greater short-term emissions are estimated for site grading with a bulldozer or tractor. This type of activity is assumed to occur for 30 work days (8-hour day) over the course of a year. The model equation for grading emissions is:

$$E = \frac{0.094(s)^{1.5}}{X^{1.4}}$$

where:

E = emission rate (g/sec)

0.094 = empirical constant (g/sec)

s = percent silt content (%)

X = percent moisture content (%)

Assuming the EPA-recommended default values of 8% for s, and 10% for X, the emission rate (E) from grading is calculated as 0.085 g/sec. Averaged over the course of a year with 30 8-hour days of grading emissions, this is 36.7 g/hr or 10.2 mg/sec of PM_{10} emissions, assuming all emissions occur during working hours.

Total annual average emissions from excavation and grading are estimated as 0.62 mg/sec + 10.2 mg/sec = 10.82 mg/sec.

Localized exposure concentrations for construction workers are estimated with a simple box model. The model treats a defined surface area as a uniform emission source over the time period of interest. The box, or mixing volume, is defined by this surface area and an assumed mixing height. The emitted PM_{10} is assumed to mix uniformly throughout the box, with dilution from surface winds.

The general model equation is:

$$C = \frac{E}{(U)(W)(H)}$$

where:

E = emission rate, mg/sec

U = wind speed, m/sec

W = crosswind width of the area source, m

H = mixing height, m

E and U are the same as defined or calculated above. To determine W, the construction activity is assumed to be confined to approximately 100 square meters at any time. This area is assumed to be square, and W is the square root of 100 m^2, or 10 meters. H is assumed to be the height of the breathing zone, or 1.75 meters.

With these values, the PM_{10} exposure concentration for a construction worker is calculated as 0.140 mg/m^3. All of this PM_{10} was assumed to be airborne soil released from SEAD 16 as represented by total soils (surface and subsurface).

The concentration of particulate-associated chemicals in ambient air, then, is:

$$CA = CS \times PM_{10} \times CF$$

where:

CA = chemical concentration in air (mg/m^3)
CS = chemical concentration in soil (mg/kg soil)
PM_{10} = PM_{10} concentration (ug/m^3)
CF = conversion factor (10^{-9} kg/ug)

These calculated CA values are the inhalation EPCs for the dust inhalation scenarios for most chemicals. One outdoor air sample was collected at SEAD 16 as a background reference as part of the indoor air sampling at the deactivation furnace building. Certain metals were detected in this sample at concentrations higher than estimated by the method described above. In these instances, the measured concentrations were used in lieu of the calculated concentrations to assess ambient air exposures. Measured concentrations were used for the following metals: copper, mercury and selenium. Table I-1 (in Appendix I) shows the inhalation EPCs for the future construction workers.

Site Worker, Future Trespasser, and Day Care Receptors

Ambient air normally contains particulate matter derived from various natural and anthropogenic sources, including soil erosion, fuel burning, automobiles, etc. The concentrations of airborne particulate matter were measured at SEDA over a four month period (April-July) in 1995. A summary of the data collected in this air sampling program is shown in Table 6-6. Both Total

Suspended Particulate Matter (TSP) and particulate matter less than 10um aerodynamic diameter (PM_{10}) were measured. TSP includes all particles which can remain suspended in air, while PM_{10} includes only smaller particles which can be inhaled (particles larger than 10um diameter typically cannot enter the narrow airways in the lung).

For this assessment, the highest 4-month average PM_{10} concentration measured at any of the four monitoring stations was assumed to represent ambient air at SEAD 16. The entire particulate loading was assumed to be airborne soil released from SEAD 16 as represented by the surface soil EPCs for the site.

The concentration of particulate-associated chemicals in ambient air, (CA) was calculated with the same equation [$CA = CS \times PM_{10} \times CF$] used for the construction worker, above.

Similar to the construction worker scenario, measured air concentrations were used as EPCs for certain metals (barium, copper, mercury and selenium). The ambient air exposure point concentrations used in the intake calculations are shown in Table I-1 (Appendix I).

The equation for intake is as follows (EPA, 1989a):

$$\textbf{Intake (mg/kg/day)} = \frac{\mathbf{CA \times IR \times EF \times ED}}{\mathbf{BW \times AT}}$$

where:

CA = Chemical concentration in air (mg/m^3)
IR = Inhalation Rate (m^3/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW = Bodyweight (kg)
AT = Averaging Time (days)

The results of these calculations are shown in Tables I-2 and I-3 for RME and CT, respectively.

6.3.5.4 Inhalation of Indoor Air

This pathway considers the inhalation of airborne particulate matter by future industrial workers inside the existing building at SEAD 16.

The indoor air data collected inside the building which housed the former deactivation furnace in the Remedial Investigation were used to calculate the EPCs for each detected compound.

The same intake equation used for exposure to ambient air, above, was used to calculate intakes from indoor air exposure. The results of these calculations are shown in Tables I-4 and I-5.

6.3.5.5 Incidental Ingestion of Soil (current and future land use)

Due to the present limited access to the SEAD 16, the current ingestion of on-site soils is limited to an infrequent site worker. Future scenarios include the construction worker, trespasser and day care receptors.

The soil data collected from the Remedial Investigation were compiled and the EPCs were calculated for each compound. For the current site worker, future trespasser and day care center exposures, only surface soil data collected from the 0 to 0.5 foot interval were used in this analysis. For the construction worker exposure, all soil data were used as it is assumed that the construction worker will engage in intrusive activities.

The equation for intake is as follows (EPA 1989a):

$$\text{Intake (mg/kg-day)} = \frac{CS \times IR \times CF \times FI \times EF \times ED}{BW \times AT}$$

Where:

CS = Chemical Concentration in Soil (mg/kg soil)
IR = Ingestion Rate (mg soil/day)
CF = Conversion Factor (1 Kg/10^6 mg)
FI = Fraction Ingested from Contaminated Source (unitless)
EF = Exposure Frequency (days/years)
ED = Exposure Duration (years)

BW = Body Weight (kg)
AT = Averaging Time (period over which exposure is averaged -- days)

The results of these calculations are shown in Tables I-6 and I-7.

6.3.5.6 Dermal Contact with Soils

The same receptors considered to have the potential to ingest soil may also contact the same soils dermally. These receptors include the current site worker, future construction worker, future trespasser and day care receptors.

As with the soil ingestion scenarios, the chemical concentration of the soils were taken from the 0 to 0.5 foot depth and used as the exposure point concentrations for the site worker, future trespasser and day care center exposures, while the chemical concentration of all soils was used as the exposure point concentration for the construction worker scenario.

The equation for the absorbed dose from dermal exposure is as follows, based on guidance in USEPA 1992:

$$\textbf{Absorbed Dose (mg/kg-day)} = \frac{\mathbf{CS \times CF \times AF \times ABS \times SA \times EF \times ED}}{\mathbf{BW \times AT}}$$

Where:

CS = Chemical Concentration in Soil (mg/kg soil)
CF = Conversion Factor (10^{-6} kg/mg)
AF = Soil to Skin Adherence Factor (mg/cm^2)
ABS = Absorption Factor (unitless)
SA = Skin Surface Area Available for Contact (cm^2)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT = Averaging Time (period over which exposure is averaged -- days)

The product of the terms CS, AF, and ABS represents the absorbed dose per event as defined in the USEPA 1992 guidance.

The exposure calculations are summarized in Tables I-8 and I-9.

Dermal exposure involves several unique exposure factors discussed briefly here. Specifically, the dermal exposure calculation considers the amount of exposed skin, the amount of soil which adheres to the skin and the degree to which a chemical may be adsorbed through the skin.

The surface area of exposed skin depends on the size of an individual (especially adult vs. child), clothing worn, and the specific parts of the body which may directly contact the medium of concern (typically soil, surface water, sediment or dust). USEPA recommendations were followed to select exposed skin surface areas for each scenario in this assessment.

The following assumptions were made regarding skin surface areas for dermal exposure, according to USEPA 1992b:

Current Site Worker, Future Industrial Worker, Future Construction Worker, and Future Day Care Center Worker The hands, legs, arms, neck and head may be exposed. These comprise approximately 25% of the total body surface area. USEPA 1992b recommends surface area values of 5800 cm^2 for the RME and 5000 cm^2 for the CT as representative of these exposed body parts.

Future Adolescent Trespasser The same body parts assumed for the workers, above, are assumed for the trespasser's exposure to soil. Based on the distribution of total body surface areas for adolescents (age 12-15), the RME value was taken as 25% of the 95th percentile value and the CT was taken as 25% of the mean value. This corresponds with values of 4625 cm^2 for the RME and 3725 cm^2 for the CT. For exposure to surface water or sediment in the drainage ditches during wading, the feet and legs were assumed to be exposed. The combined surface area of these body parts is also approximately 25% of the total body, so the same RME and CT values used for soil exposure were used for surface water exposure.

Day Care Child 25% of total body area was assumed for children age 3-6. This results in surface area exposure values of 2190 cm^2 for the RME and 1820 cm^2 for the CT.

The potential magnitude of exposure depends on the amount of soil which adheres to the exposed skin. Again, USEPA recommended soil-to-skin adherence factors were used in this assessment.

Certain chemicals may be readily absorbed through the skin while others penetrate much more slowly or not at all. In the case of solid media (soil, sediment, and dust) some chemicals may be strongly bound to the matrix which reduces their ability to absorb through the skin. Chemical-specific absorption factors as provided by USEPA were used in this assessment. USEPA Region II recommends quantifying dermal exposure for cadmium, arsenic, PCBs, dioxins/furans and pentachorophenol (others are under development) only since credible values are not available for other chemicals of concern. Of these compounds, only PCBs and pentachorophenol were detected in any soil. For PCBs, an absorption factor (ABS) of 6 percent (0.06 was used in the total soils scenario for the future construction worker, which is at the high end of the range recommended by EPA, 0.6 to 6 percent (EPA, 1992b). The absorption factor used for pentachlorophenol is 1% (0.01).

No other compounds were considered quantitatively for dermal exposure from soil in this risk assessment.

The reader should note that in the guidance document Dermal Exposure Assessment: Principles and Applications (USEPA 1992b), EPA cautions that "dermal exposure is the least well understood of the major exposure routes. Very little chemical-specific data are available, especially for soils, and the predictive techniques have not been well validated." EPA further states that dermal exposure/risk estimates have considerable uncertainty, and in some cases may be overly conservative.

6.3.5.7 Incidental Ingestion of Indoor Surface Dust

Future industrial workers in the furnace deactivation building may contact and ingest dust which has settled on surfaces in the building. Chemical data for this exposure route is represented by the solids collected inside the building and analyzed in the Remedial Investigation. The RME and CT EPCs for this exposure pathway were calculated for each compound from this data set.

The same intake equation used for ingestion of soil was used to calculate intakes from ingestion of indoor dust. The chemical concentrations in indoor solids (mg/kg) were used in place of soil concentrations. The results of these calculations are shown in Tables I-10 and I-11.

6.3.5.8 Incidental Dermal Contact with Indoor Surface Dust

Future industrial workers in the furnace deactivation building may dermally contact surface dust inside the building. The RME and CT EPCs for this exposure pathway were the same as those calculated for surface dust ingestion, above.

The same intake equation used for dermal contact with soil was used to calculate intakes from dermal contact with indoor dust. The chemical concentrations in indoor solids (mg/kg) were used in place of soil concentrations. Of the compounds recommended by USEPA Region II for dermal exposure assessment (see discussion in Section 6.3.5.6), pentachorophenol, PCBs, antimony and cadmium were detected in indoor solids. The same dermal absorption factors (ABS) used for pentachlorophenol and PCBs in soil were used here. Dermal absorption factors (ABS) of 0.1% (0.001) for antimony and 1% percent (0.01) for cadmium were used (EPA 1992b). No other compounds were evaluated quantitatively for dermal adsorption from sediment. The results of these calculations are shown in Tables I-12 and I-13.

6.3.5.9 Dermal Contact to Surface Water while Wading (Future)

Due to the present limited access to SEAD 16, contact with on-site surface water applies only to future receptors. Since the surface water points are seasonal, intermittent and shallow (occurring in drainage ditches at the site), only the trespasser comes into contact with this water.

The Exposure Point Concentrations (EPCs) for each chemical of concern were calculated based on all surface water data collected during the RI sampling. This results in a conservative exposure estimate since current concentrations are likely to be reduced over time.

The equation for the dermally absorbed dose is as follows (USEPA, 1992b):

$$\textbf{Absorbed Dose (mg/kg-day)} = \frac{\textbf{DA x SA x EF x ED}}{\textbf{BW x AT}}$$

Where:

DA = Absorbed Dose per event (mg/cm^2 - event)
SA = Skin Surface Area Available for Contact (cm^2)
EF = Exposure Frequency (events/year)

ED = Exposure Duration (years)
BW = Body Weight (kg)
AT = Averaging Time (period over which exposure is averaged -- days)

The exposure calculations are summarized in Tables I-14 and I-15.

The absorbed dose per event (DA) was calculated as described in EPA's "Dermal Exposure Assessment: Principles and Applications" (USEPA, 1992b).

For organics, a parameter, B is first calculated. The B value was adopted from the Bunge Model (Cleek and Bunge, 1992). This value attempts to characterize the relative contribution of each compounds specific permeability coefficient (Kp value) in the stratum corneum and the viable epidermis. The B-values for certain compounds are listed in Table 5-8 of the Dermal Exposure Assessment Manual, USEPA, 1992b. For any compounds not listed in this table, B-values are derived using the following equation:

$$B \approx \frac{\mathrm{Ko/w}}{10{,}000}$$

where: Kow is the octanol-water partitioning coefficient (dimensionless).

Once calculated, the B value is used to calculate time conditions associated with estimates of compound breakthrough time. In accordance with the work of Cleek and Bunge, if the exposure time per event (ET) is less than the breakthrough time (t*) of steady-state conditions specific to each compound, then the absorbed dose is calculated as follows:

$$\mathbf{DA = 2\ K_p\ x\ CW}\sqrt{\frac{6 \times \tau \ \times \mathrm{ET}}{\pi}}\quad CF$$

If the exposure time is longer than t*, then the absorbed dose is calculated using:

$$\mathbf{DA_{event} = K_p\ x\ CW}\left[\frac{\mathrm{ET} + 2(1 + 3\mathrm{B})t}{1 + \mathrm{B}}\right] \mathrm{x\ CF}$$

where for both equations:

K_p = Dermal permeability coefficient (cm/hr)
CW = Chemical Concentration in Water (mg/l)
ET = Exposure Time (hours)
B = Bunge Model Value (unitless)
τ = Lag time (hours)
CF = Volume conversion factor = 0.001 l/cm^3

The lag time (τ), is defined as the time it takes a chemical to penetrate to reach a steady-state condition during a dermal exposure in aqueous media. By properly defining the lag time, the permeability coefficient (Kp) can be more properly used in the risk calculation further reducing uncertainty. The lag time and breakthrough time (t*) for each organic compound was taken from Table 5-8 of the Dermal Exposure Assessment Manual (USEPA, 1992b).

The t* value for each organic compound found in surface water is shown below.

Compound	t* (hours)
di-n-butylphthalate	29
pentachlorophenol	17
bis(2-ethylhexyl)phthalate	100

The exposure time, one hour, is less than t* in all cases. Therefore, the first equation for DA, above, was used for all compounds.

For inorganics, DA was calculated by:

$$\mathbf{DA = K_p \times CW \times ET \times CF}$$

In the Dermal Exposure Assessment Manual (USEPA, 1992b), USEPA recommends Dermal Permeability Coefficients (K_p) for a number of organic and inorganic chemicals. These recommended values were used in these exposure calculations.

Many inorganic compounds do not have specified recommended K_p values. In this case, K_p was assumed to be 1×10^{-3} as the default value recommended by EPA (USEPA, 1992b).

The duration of skin contact with surface water during each incident must be defined for these calculations. Based on guidance in the Dermal Exposure Assessment document, an RME Exposure Time of 1 hour/day and CT 0.5 hour/day was used. Because little data exists on potential Exposure Frequency, the assessor determined an RME value of 25 days/year and a CT value of 13 days/year. The basis for these assumptions were regional climate, availability of the surface water on the site, and available data on recreational water contact. These value are probably conservative, since the surface waters are minimal on the site and do not support groundwater recreation.

6.3.5.10 Incidental Ingestion of Sediment (future)

Ingestion of sediment is assumed to occur when the drainage ditches are dry, when the sediment could potentially be ingested in the same manner as soil. This pathway is assumed to have the same exposure frequency (EF) and exposure duration (ED) used for the surface water pathway, since ingestion of dry sediment is expected to be about as infrequent as wading in the wet drainage ditches. As with the surface water, only the future trespasser is considered for this exposure route.

The Exposure Point Concentrations (EPCs) for each chemical of concern were calculated based on all sediment data collected in the RI sampling program.

The chemical intake from ingestion of sediment is calculated by the same method used for ingestion of soil. The equation for intake is as follows (USEPA, 1989a):

$$\textbf{Intake (mg/kg-day)} = \frac{\textbf{CS x IR x CF x FI x EF x ED}}{\textbf{BW x AT}}$$

Where:

CS = Chemical Concentration in Sediment (mg/kg)
IR = Ingestion Rate (mg sediment/kg)
CF = Conversion Factor (10^{-6} kg/mg)
EF = Exposure Frequency (days/years)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT = Averaging Time (period over which exposure is averaged -- days)

The results of these calculations are shown in Tables I-16 and I-17.

6.3.5.11 Dermal Exposure to Sediment while Wading (Future)

The same receptor considered to have the potential to ingest sediment may also contact the same sediment dermally. This receptor is the future trespasser.

The EPCs for dermal contact with sediment are the same ones calculated for ingestion exposure. The absorbed chemical dose from dermal contact with sediment is calculated by the same method used for soils except that CS is the chemical concentration in sediment (mg/kg-sediment), rather than soil.

The results of the calculations are shown in Tables I-18 and I-19.

Similar to soil, the sediment dermal exposure calculation considers the amount of exposed skin, the amount of soil which adheres to the skin and the degree to which a chemical may be adsorbed through the skin. As with soil, this assessment followed USEPA guidance regarding the values assigned to each of these exposure parameters.

Of the compounds recommended by USEPA Region II for dermal exposure assessment (see discussion in Section 6.3.5.6), PCBs, arsenic and cadmium were detected in sediment. The same dermal absorption factors (ABS) used for PCBs and cadmium in indoor solids were used here. A dermal adsorption factor (ABS) of 0.1 percent (0.001) is used for arsenic (EPA, 1992b). No other compounds were considered quantitatively for dermal exposure for sediment.

6.3.5.12 Groundwater Ingestion (Future)

The water supply within the Depot boundaries is not from the aquifer under the site. Currently, all water used at the SEDA is piped up from nearby Seneca Lake. Therefore, exposures from on-site usage of groundwater are quantified only for future receptors.

The Round I and Round II groundwater sampling programs performed during the RI and the sampling results from the ESI were used as the foundation to establish exposure concentrations for all groundwater chemicals of concern. The EPC was calculated for all compounds used in the future land use scenario.

The equation for intake is as follows (USEPA, 1989a):

$$\textbf{Intake (mg/kg-day)} = \frac{\textbf{CW x IR x EF x ED}}{\textbf{BW x AT}}$$

Where:
CW = Chemical Concentration in Water (mg/liter)
IR = Ingestion Rate (liters/day)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
BW = Bodyweight (kg)
AT = Averaging time (days)

The results of these calculations are shown in Tables I-20 and I-21.

6.4 TOXICITY ASSESSMENT

The objective of the toxicity assessment is to weigh available evidence regarding the potential of the chemicals to cause adverse effects in exposed individuals, and to provide, where possible, an estimate of the relationship between the extent of exposure to a chemical and the increased likelihood and/or severity of adverse effects. The types of toxicity information considered in this assessment include the reference dose (RfD) and reference concentration (RfC) used to evaluate noncarcinogenic effects, and the slope factor and unit risk to evaluate carcinogenic potential. Most toxicity information used in this evaluation was obtained from the Integrated Risk Information System (IRIS). If values were not available from IRIS, the *Health Effects Assessment Summary Tables* (HEAST) (USEPA, 1994) were consulted. Finally, the USEPA Region II was consulted to provide any additional values not included in these two sources. The toxicity factors used in this evaluation are summarized in Table 6-7 for both noncarcinogenic and carcinogenic effects.

TABLE 6-7

TOXICITY VALUES

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Analyte	Oral RfD (mg/kg-day)		Inhalation RfD (mg/kg-day)		Carc. Slope Oral (mg/kg-day)-1		Rank Wt. of Evidence	Carc. Slope Inhalation (mg/kg-day)-1		Dermal RfD (mg/kg-day)		Carc. Slope Dermal (mg/kg-day)-1		Oral Absorption Factor	
Volatile Organics															
Trichloroethane, 1,1,1-	2.00E-02	i	2.86E-01	i	NA	e	D	NA	e	2.00E-02	f	NA	g	1	j
Tetrachloroethane, 1,1,2,2-	NA	a	NA	a	2.00E-01	a	C	2.03E-01	a	NA	f	2.00E-01	g	1	j
Butanone, 2-	6.00E-01	a	2.86E-01	a	NA	e	D	NA	e	6.00E-01	f	NA	g	1	j
Acetone	1.00E-01	a	NA	e	NA	e	D	NA	e	1.00E-01	f	NA	g	1	j
Benzene	3.00E-03	i	1.71E-03	i	2.90E-02	a	A	2.91E-02	a	2.85E-03	f	3.05E-02	g	0.95	k
Carbon Disulfide	1.00E-01	a	2.00E-01	b	NA	e	NA	NA	e	6.30E-02	f	NA	g	0.63	k
Bromomethane	1.40E-03	a	1.43E-03	a	NA	a	D	NA	a	1.40E-03	f	1.43E-03	g	1	j
Chloroform	1.00E-02	a	NA	e	6.10E-03	a	B2	8.05E-02	a	1.00E-02	f	6.10E-03	g	1	k
Chloromethane	NA	a	NA	a	1.30E-02	a	C	6.33E-03	a	NA	f	1.30E-02	g	1	k
Methylene Chloride	6.00E-02	a	8.57E-01	b	7.50E-03	a	B2	1.65E-03	a	5.88E-02	f	7.65E-03	g	0.98	k
Toluene	2.00E-01	a	1.14E-01	a	NA	e	D	NA	e	2.00E-01	f	NA	g	1	j
Trichloroethene	NA	e	NA	e	1.10E-02	e	NA	6.00E-03	e	NA	f	1.22E-02	g	0.9	k
Xylene (total)	2.00E+00	a	NA	e	NA	e	D	NA	e	1.80E+00	f	NA	g	0.9	k
Semivolatiles*															
Dinitrotoluene, 2,4-	2.00E-03	a	NA	a	6.80E-01	a	B2	NA	a	2.00E-03	f	6.80E-01	g	1	j
Dinitrotoluene, 2,6-	1.00E-03	b	NA	a	6.80E-01	a	NA	NA	a	1.00E-03	f	6.80E-01	g	1	j
Methylnaphthalene, 2-	4.00E-02	i	NA	e	NA	e	NA	NA	e	4.00E-02	f	NA	g	1	j
Methylphenol, 2-	5.00E-02	a	NA	e	NA	e	C	NA	e	5.00E-02	f	NA	g	1	j
Dichlorobenzidine, 3,3'-	NA	e	NA	e	4.50E-01	a	B2	NA	e	NA	f	4.50E-01	g	1	j
Nitroaniline, 3-	NA	e	NA	e	NA	e	NA	NA	e	NA	f	NA	g	1	j
Acenaphthene	6.00E-02	a	NA	e	NA	e	NA	NA	e	6.00E-02	f	NA	g	1	j
Acenaphthylene	NA	e	NA	e	NA	e	D	NA	e	NA	f	NA	g	1	j
Anthracene	3.00E-01	a	NA	e	NA	e	D	NA	e	3.00E-01	f	NA	g	1	j
Benzoic Acid	4.00E+00	a	NA	a	NA	a	NA	NA	a	4.00E+00	f	NA	g	1	j
Benzo(a)anthracene	NA	e	NA	e	7.30E-01	c	B2	NA	e	NA	f	7.30E-01	g	1	j
Benzo(a)pyrene	NA	e	NA	e	7.30E+00	a	B2	NA	e	NA	f	1.83E+01	g	0.4	k
Benzo(b)fluoranthene	NA	e	NA	e	7.30E-01	c	B2	NA	e	NA	f	7.30E-01	g	1	j
Benzo(g,h,i)perylene	NA	e	NA	e	NA	e	D	NA	e	NA	f	NA	g	1	j
Benzo(k)fluoranthene	NA	e	NA	e	7.30E-02	c	B2	NA	e	NA	f	7.30E-02	g	1	j
Butylbenzylphthalate	2.00E-01	b	NA	e	NA	e	C	NA	e	2.00E-01	f	NA	g	1	j
Carbazole	NA	e	NA	e	2.00E-02	b	B2	NA	e	NA	f	2.00E-02	g	1	j
Chrysene	NA	e	NA	e	7.30E-03	c	B2	NA	e	NA	f	7.30E-03	g	1	j
Di-n-butylphthalate	1.00E-01	a	NA	e	NA	e	D	NA	e	9.00E-02	f	NA	g	0.9	k
Dibenz(a,h)anthracene	NA	e	NA	e	7.30E+00	c	B2	NA	e	NA	f	7.30E+00	g	1	j
Dibenzofuran	NA	e	NA	e	NA	e	D	NA	e	NA	f	NA	g	1	j
Diethylphthalate	8.00E-01	b	NA	e	NA	e	D	NA	e	8.00E-01	f	NA	g	1	j
Fluoranthene	4.00E-02	a	NA	e	NA	e	D	NA	e	4.00E-02	f	NA	g	1	j
Fluorene	4.00E-02	a	NA	e	NA	e	D	NA	e	4.00E-02	f	NA	g	1	j
Indeno(1,2,3-cd)pyrene	NA	e	NA	e	7.30E-01	c	B2	NA	e	NA	f	7.30E-01	g	1	j
N-Nitrosodiphenylamine	NA	e	NA	e	4.90E-03	a	B2	NA	e	NA	f	4.90E-03	g	1	j
Naphthalene	4.00E-02	e	NA	e	NA	e	D	NA	e	4.00E-02	f	NA	g	1	j
Pentachlorophenol	3.00E-02	a	NA	e	1.20E-01	a	B2	NA	e	3.00E-02	f	1.20E-01	g	1	j
Phenanthrene	NA	e	NA	e	NA	e	D	NA	e	NA	f	NA	g	1	j
Phenol	6.00E-01	a	NA	e	NA	e	D	NA	e	5.40E-01	f	NA	g	0.9	k
Pyrene	3.00E-02	a	NA	e	NA	e	NA	NA	e	3.00E-02	f	NA	g	1	k
bis(2-Ethylhexyl)phthalate	2.00E-02	a	NA	e	1.40E-02	a	B2	NA	e	1.00E-02	f	2.80E-02	g	0.5	k
Pesticides/PCBs															
DDD, 4,4'-	NA	a	NA	e	2.40E-01	a	B2	NA	e	NA	f	1.20E+00	g	0.2	k
DDE, 4,4'-	NA	e	NA	e	3.40E-01	e	B2	NA	e	NA	f	1.70E+00	g	0.2	k
DDT, 4,4'-	5.00E-04	a	NA	e	3.40E-01	a	B2	3.40E-01	a	1.00E-04	f	1.70E+00	g	0.2	k
Aldrin	3.00E-05	a	NA	b	1.70E+01	a	B2	1.72E+01	a	1.50E-05	f	3.40E+01	g	0.5	k
Aroclor-1254	2.00E-05	a	NA	a	2.00E+00	a	B2	4.00E-01	a	1.80E-05	f	2.22E+00	g	0.9	k
Aroclor-1260	2.00E-05	a	NA	a	2.00E+00	a	B2	4.00E-01	a	1.80E-05	f	2.22E+00	g	0.9	k
Dieldrin	5.00E-05	a	NA	e	1.60E+01	a	B2	1.61E+01	a	2.50E-05	f	3.20E+01	g	0.5	k
Endosulfan I	6.00E-03	b	NA	e	NA	e	NA	NA	e	6.00E-03	f	NA	g	1	j
Endosulfan II	6.00E-03	e	NA	e	NA	e	NA	NA	e	6.00E-03	f	NA	g	1	j
Endosulfan sulfate	6.00E-03	b	NA	e	NA	e	NA	NA	e	6.00E-03	f	NA	g	1	j
Endrin	3.00E-04	a	NA	e	NA	e	D	NA	e	3.00E-04	f	NA	g	1	j
Endrin aldehyde	NA	e	NA	e	NA	e	NA	NA	e	NA	f	NA	g	1	j
Endrin ketone	NA	e	NA	e	NA	e	NA	NA	e	NA	f	NA	g	1	j

TABLE 6-7

TOXICITY VALUES

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Analyte	Oral RfD (mg/kg-day)		Inhalation RfD (mg/kg-day)		Carc. Slope Oral (mg/kg-day)-1		Rank Wt. of Evidence	Carc. Slope Inhalation (mg/kg-day)-1		Dermal RfD (mg/kg-day)		Carc. Slope Dermal (mg/kg-day)-1		Oral Absorption Factor	
Heptachlor	5.00E-04	a	NA	e	4.50E+00	a	B2	4.55E+00	a	5.00E-04	f	4.50E+00	g	1	j
Heptachlor epoxide	1.30E-05	a	NA	e	9.10E+00	a	B2	9.10E+00	a	1.30E-05	f	9.10E+00	g	1	j
Toxaphene	NA	a	NA	a	1.10E+00	a	B2	1.12E+00	a	NA	f	1.10E+00	g	1	j
alpha-BHC	NA	e	NA	e	6.30E+00	a	B2	6.30E+00	a	NA	f	NA	g	1	j
alpha-Chlordane	6.00E-05	b	NA	e	1.30E+00	a	B2	1.30E+00	e	6.00E-05	f	1.30E+00	g	1	j
beta-BHC	NA	e	NA	e	1.80E+00	a	C	1.86E+00	a	NA	f	1.80E+00	g	1	j
gamma-BHC	3.00E-04	a	NA	e	1.30E+00	e	NA	NA	e	3.00E-04	f	NA	g	1	j
gamma-Chlordane	6.00E-05	e	NA	e	1.30E+00	e	NA	1.30E+00	e	6.00E-05	f	1.30E+00	g	1	j
delta-BHC	NA	e	NA	e	NA	e	NA	NA	e	NA	f	NA	g	1	j
Nitroaromatics*															
2,4-Dinitrotoluene	2.00E-03	a	NA	a	6.80E-01	a	B2	NA	a	2.00E-03	f	6.80E-01	g	1	j
2,6-Dinitrotoluene	1.00E-03	b	NA	a	6.80E-01	a	NA	NA	a	1.00E-03	f	6.80E-01	g	1	j
1,3,5-Trinitrobenzene	5.00E-05	a	NA	a	NA	a	NA	NA	a	5.00E-05	f	NA	g	1	j
2,4,6-Trinitrotoluene	5.00E-04	a	NA	a	3.00E-02	a	C	NA	a	5.00E-04	f	3.00E-02	g	1	j
2-amino-4,6-Dinitrotoluene	NA	a	NA	a	NA	a	NA	NA	a	NA	f	NA	g	1	j
Tetryl	1.00E-02	b	NA	a	NA	a	NA	NA	a	1.00E-02	f	NA	g	1	j
Metals															
Aluminum	1.00E+00	m	1.43E-03	m	NA	m	D	NA	m	NA	m	NA	m	0.04	k
Antimony	4.00E-04	b	NA	e	NA	m	D	NA	e	4.00E-04	f	NA	g	0.01	k
Arsenic	3.00E-04	a	NA	e	1.50E+00	d	A	1.51E+01	a	2.40E-04	f	1.88E+00	g	0.8	k
Barium	7.00E-02	a	1.43E-04	b	NA	e	NA	NA	e	3.50E-03	f	NA	g	0.05	k
Beryllium	5.00E-03	a	NA	e	4.30E+00	a	B2	8.40E+00	a	5.00E-05	f	4.30E+02	g	0.01	k
Cadmium	5.00E-04	a	NA	e	NA	e	B1	6.30E+00	a	5.00E-05	f	NA	g	0.1	l
Calcium	NA	e	NA	e	NA	e	NA	NA	e	NA	f	NA	g	1	j
Chromium	5.00E-03	a	NA	e	NA	e	A	4.20E+01	a	1.00E-04	f	NA	g	0.02	k
Cobalt	NA	m	NA	e	NA	e	NA	NA	e	NA	f	NA	g	0.05	k
Copper	4.00E-02	b	NA	e	NA	e	D	NA	e	2.40E-02	f	NA	g	0.6	k
Cyanide	2.00E-02	a	NA	e	NA	e	D	NA	e	1.00E-02	f	NA	g	0.5	k
Iron	3.00E-01	e	NA	e	NA	e	D	NA	e	3.00E-01	f	NA	g	1	j
Lead	NA	e	NA	e	NA	e	B2	NA	e	NA	f	NA	g	0.15	k
Magnesium	NA	e	NA	e	NA	e	D	NA	e	NA	f	NA	g	1	j
Manganese	5.00E-02	a	1.40E-05	a	NA	e	D	NA	e	1.50E-03	f	NA	g	0.03	k
Mercury	3.00E-04	b	8.57E-05	b	NA	e	D	NA	e	3.00E-06	f	NA	g	0.01	k
Nickel	2.00E-02	a	NA	e	NA	e	A	NA	b	8.00E-04	f	NA	g	0.04	k
Potassium	NA	e	NA	e	NA	e	NA	NA	e	NA	f	NA	g	1	j
Selenium	5.00E-03	b	NA	e	NA	e	NA	NA	e	4.50E-03	f	NA	g	0.9	k
Silver	5.00E-03	a	NA	e	NA	e	D	NA	e	1.00E-03	f	NA	g	0.2	k
Sodium	NA	e	NA	e	NA	e	NA	NA	e	NA	f	NA	g	1	j
Thallium	8.00E-05	b	NA	e	NA	e	NA	NA	e	8.00E-05	f	NA	g	1	k
Vanadium	7.00E-03	b	NA	e	NA	e	D	NA	e	7.00E-05	f	NA	g	0.01	k
Zinc	3.00E-01	a	NA	e	NA	e	D	NA	e	7.50E-02	f	NA	g	0.25	k
Herbicides															
2,4,5-T	1.00E-02	a	NA	a	NA	a	NA	NA	a	1.00E-02	f	NA	g	1	j
2,4,5-TP (Silvex)	8.00E-03	a	NA	e	NA	e	D	NA	e	8.00E-03	f	NA	g	1	j
2,4-D	1.00E-02	a	NA	e	NA	e	NA	NA	e	1.00E-02	f	NA	g	1	j
2,4-DB	8.00E-03	a	NA	e	NA	e	NA	NA	e	8.00E-03	f	NA	g	1	j
Dichloroprop	NA	a	NA	a	NA	a	NA	NA	a	NA	f	NA	g	1	j
MCPA	5.00E-04	a	NA	e	NA	e	NA	NA	e	5.00E-04	f	NA	g	1	j
MCPP	1.00E-03	a	NA	e	NA	e	NA	NA	e	1.00E-03	f	NA	g	1	j
Additional Compounds															
Dimethylphenol, 2,4-	2.00E-02	a	NA	e	NA	e	NA	NA	e	2.00E-02	f	NA	g	1	j
Nitroaniline, 4-	NA	e	NA	e	NA	e	NA	NA	e	NA	f	NA	g	1	j
N-Nitroso-di-n-propylamine	NA	e	NA	e	7.00E+00	e	NA	NA	e	NA	f	7.00E+00	g	1	j
bis(2-Chloroisopropyl) ether	4.00E-02	h	NA	h	7.00E-02	h	NA	3.50E-02	h	4.00E-02	f	7.00E-02	g	1	j
Chloroaniline, 4-	4.00E-03		NA		NA		NA	NA		NA		NA		1	i
Dinitrobenzene, 1,3-	1.00E-04		NA		NA		D	NA		NA		NA		1	i

a = Taken from the Integrated Risk Information System (IRIS) (Online December 1997)
b = Taken from HEAST 1995
c = Calculated using TEF
d = Calculated from proposed oral unit risk value
e = Provided by USEPA - October 1993
f = Calculated from oral RFD value
g = Calculated from oral slope factor
i = Provisional health guideline from EPA Risk Assessment Issue Papers (1995-1996) provided by EPA Technical Support Center
(Inhalation RfD's were derived from EPA RfC's based on the assumption of 20 m3/day inhalation rate and 70 kg body weight)
j = Where no oral absorption efficiency data are available, EPA Region 2 recommends that no adjustment be made for relative absorption (i.e. assume oral absorption factor
k = Taken from ATSDR Toxicity Profiles (1989 - 1995)
l = EPA Region 2 accepted oral absorption factor for cadmium (personal communication between A. Schatz of Parsons and M. Maddaloni of EPA)
m = Provisional health guideline from EPA Risk Assessment Issue Papers (1997) provided by EPA Technical Support Center
(Inhalation RfD's were derived from EPA RfC's based on the assumption of 20 m3/day inhalation rate and 70 kg body weight.)
NA = Not Available
*Dinitrotoluene, 2,4- and dinitrotoluene, 2,6- were analyzed as both nitroaromatics and semivolatiles.

6.4.1 Noncarcinogenic Effects

For chemicals that exhibit noncarcinogenic (i.e., systemic) effects, authorities consider organisms to have repair and detoxification capabilities that must be exceeded by some critical concentration (threshold) before the health effect is manifested. For example, an organ can have a large number of cells performing the same or similar functions that must be significantly depleted before the effect on the organ is seen. This threshold view holds that a range of exposures from just above zero to some finite value can be tolerated by the organism without an appreciable risk of adverse effects.

Health criteria for chemicals exhibiting noncarcinogenic effects for use in risk assessment are generally developed using USEPA RfDs and RfCs developed by the RfD/RfC Work Group and included in the IRIS. In general, the RfD/RfC is an estimate of an average daily exposure to an individual (including sensitive individuals) below which there will not be an appreciable risk of adverse health effects. The RfD/RfC is derived using uncertainty factors (e.g., to adjust from animals to humans and to protect sensitive subpopulations) to ensure that it is unlikely to underestimate the potential for adverse noncarcinogenic effects to occur. The purpose of the RfD/RfC is to provide a benchmark against which an intake (or an absorbed dose in the case of dermal contact) from human exposure to various environmental conditions might be compared. Intakes of doses that are significantly higher that the RfD/RfC may indicate that an inadequate margin of safety could exist for exposure to that substance and that an adverse health effect could occur.

6.4.1.1 References Doses for Oral and Inhalation Exposure

The types of toxicity values used to evaluate the noncarcinogenic effects of chemicals include RfDs for oral exposure, and RfCs for inhalation exposure. RfDs and RfCs represent thresholds for toxicity. They are derived such that human lifetime exposure to a given chemical via a given route at levels at or below the RfD or RfC, as appropriate, should not result in adverse health effects, even for the most sensitive members of the population. The chronic RfD or RfC for a chemical is ideally based on studies where either animal or human populations were exposed to a given chemical by a given route of exposure for the major portion of the life span (referred to as a chronic study). Various effect levels may be determined in a study; however, the preferred effect level for calculating noncarcinogenic toxicity values is the no-observed-adverse-effect level, or NOAEL. Second to the NOAEL is the lowest-observed-adverse-effect level, or LOAEL.

The oral RfD is derived by determining dose-specific effect levels from all the available quantitative studies, and applying uncertainty factors and/or a modifying factor to the most appropriate effect level. Uncertainty factors are intended to account for 1) the variation in sensitivity among members of the human population, 2) the uncertainty in extrapolating animal data to humans, 3) the uncertainty in extrapolating from data obtained in a study that is less than lifetime exposure, 4) the uncertainty in using LOAEL data rather than NOAEL data, and 5) the uncertainty resulting from inadequacies in the data base. The modifying factor may be used to account for other uncertainties such as inadequacy of the number of animals in the critical study. Usually each of these uncertainty factors is set equal to 10, while the modifying factor varies between one and 10. RfDs are reported as doses in milligrams of chemical per kilogram body weight per day (mg/kg-day).

The inhalation RfC is derived by determining concentration-specific effect levels from all of the available literature and transforming the most appropriate concentration to a human RfC. Transformation usually entails converting the concentration and exposure duration used in the study to an equivalent continuous 24-hour exposure, transforming the exposure-adjusted value to account for differences in animal and human inhalation, and then applying uncertainty factors and/or a modifying factor to the adjusted human exposure concentration to arrive at an RfC. The uncertainty factors potentially used are the same ones used to arrive at an RfD (see above). RfCs are reported as concentrations in milligrams of chemical per cubic meter of air (mg/m^3). To use the RfCs in calculating risks, they were converted to inhalation reference doses in units of milligrams of chemical per kilogram of body weight per day (mg/kg/day). This conversion was made by assuming an inhalation rate of 20 m^3/day and an adult body weight of 70 kg. Thus:

$$\textbf{Inhalation Reference Dose (mg/kg/day)} = RfC\left(\frac{mg}{m^3}\right)x\left(\frac{20m^3}{day}\right)x\left(\frac{1}{70kg}\right)$$

6.4.1.2 Reference Doses for Dermal Exposure

USEPA has not derived toxicity values for all routes of exposure. Most of the available toxicity values are for oral exposure. Many inhalation values are also available. No values are currently available for dermal exposure. This is due to the lack of scientific studies available to quantify dermal toxicity and carcinogenic potential for the vast majority of priority pollutants. In addition, until recently, scientists have assumed that the hazards due to dermal exposures were minimal in comparison with those due to oral exposure. However, it appears that in many instances the hazards due to dermal exposure may be as great or greater.

In the absence of dermal reference toxicity values, USEPA has suggested (USEPA, 1989a) that in some cases it is appropriate to modify an oral RfD so it can be used to estimate the hazard incurred by dermal exposure. This requires that the toxic endpoints observed are the same for both oral and dermal exposure, and that one have quantitative estimates of both dermal and oral absorption of the chemical. This information is not available for most priority pollutants, and oral toxicity values are nevertheless often used to quantify risks associated with dermal exposure. As a consequence, any valuation of the contribution of dermal exposure to the overall hazard needs to be viewed as highly tentative at best.

USEPA RAGS (1989a) provides guidance for use of oral toxicity values in determining dermal toxicity. RfDs are expressed as the amount of substance administered per unit time and unit body weight (administered-dose), whereas exposure estimates for the dermal route of exposure are expressed as the amount of substance absorbed into the body per unit time and unit body weight (absorbed-dose). Thus, for dermal exposure to contaminants in water or in soil, it is necessary to adjust an oral toxicity value from an administered to an absorbed dose. Where oral absorption efficiencies were available, the oral RfD was converted to a dermal RfD by multiplying by oral absorption efficiency. Oral absorption factors and the calculated dermal RfDs are shown in Table 6-7.

In the absence of any information on absorption for the substance or chemically related substances, an oral absorption efficiency of 100 percent was assumed in accordance with USEPA Region 2 guidance (personal communication between A. Schatz of Parsons and M. Maddeloni of EPA Region 2).

6.4.1.3 Exposure Periods

As mentioned earlier, chronic RfDs and RfCs are intended to be set at levels such that human lifetime exposure at or below these levels should not result in adverse health effects, even for the most sensitive members of the population. These values are ideally based on chronic exposure studies in humans or animals. Chronic exposure for humans is considered to be exposure of roughly seven years or more, based on exposure of rodents for one year or more in animal toxicity studies. For children, trespassers, and construction workers, chronic RfDs and RfCs were used to conservatively assess risks for shorter exposure periods.

6.4.2 Health Criteria for Carcinogenic Effects

For chemicals that exhibit carcinogenic effects, most authorities recognize that one or more molecular events can evoke changes in a single cell or a small number of cells that can lead to tumor formation. This is the non-threshold theory of carcinogenesis which purports that any level of exposure to a carcinogen can result in some finite possibility of generating the disease. Generally, regulatory agencies assume the non-threshold hypothesis for carcinogens in the absence of information concerning the mechanisms of action for the chemical of concern.

USEPA's Carcinogen Risk Assessment Verification Endeavor (CRAVE) has developed slope factors and unit risks (i.e., dose-response values) for estimating excess lifetime cancer risks associated with various levels of lifetime exposure to potential human carcinogens. The carcinogenic slope factors can be used to estimate the lifetime excess cancer risk associated with exposure to a potential carcinogen. Risks estimated using slope factors are considered unlikely to underestimate actual risks, but they may overestimate actual risks. Excess lifetime cancer risks are generally expressed in scientific notation. An excess lifetime cancer risk of 1 x 10^{-6} (one in a million), for example, represents the probability of an individual developing cancer over a lifetime as a result of exposure to the specific carcinogenic chemical. USEPA considers total excess lifetime cancer risks within the range of 10^{-4} (one in ten thousand) to 10^{-6} (USEPA, 1989a) to be acceptable when developing remedial alternatives for cleanup of Superfund Sites.

In practice, slope factors are derived from the results of human epidemiology studies or chronic animal bioassays. The data from animals studies are fitted to the linearized, multistage model and a dose-response curve is obtained. The upper limit of the 95th percentile confidence-interval slope of the dose-response curve is subjected to various adjustments, and an interspecies scaling factor is applied to conservatively derive the slope factor for humans. This linearized multistage procedure leads to a plausible upper limit of the risk that is consistent with some proposed mechanisms of carcinogenesis. Thus, the actual risks associated with exposure to a potential carcinogen are not likely to exceed the risks estimated using these slope factors, but they may be much lower. Dose-response data derived from human epidemiological studies are fitted to dose-time-response curves on an ad-hoc basis. These models provide rough but plausible estimates of the upper limits on lifetime risk. Slope factors based on human epidemiological data are also derived using very conservative assumptions and, as such, are considered unlikely to underestimate risks. In summary, while the actual risks associated with exposures to potential carcinogens are unlikely to be higher than the risks calculated using a slope factor, they could be considerably lower.

In addition, there are varying degrees of confidence in the weight of evidence for carcinogenicity of a given chemical. The USEPA system involves characterizing the overall weight of evidence for a chemical's carcinogenicity based on availability of animal, human, and other supportive data. The weight-of-evidence classification is an attempt to determine the likelihood that the agent is a human carcinogen, and thus qualitatively affects the estimation of potential health risks. Three major factors are considered in characterizing the overall weight of evidence for carcinogenicity: (1) the quality of evidence from human studies, (2) the quality of evidence from animal studies, which are combined into a characterization of the overall weight of evidence for human carcinogenicity; and (3) other supportive information which is assessed to determine whether the overall weight of evidence should be modified. USEPA's final classification of the overall weight of evidence includes the following five categories:

Group A - Human Carcinogen - There is sufficient evidence from epidemiological studies to support a causal association between an agent and cancer.

Group B - Probable Human Carcinogen - There is at least limited evidence from epidemiological studies of carcinogenicity to humans (Group B1) or that, in the absence of adequate data on humans, there is sufficient evidence of carcinogenicity in animals (Group B2).

Group C - Possible Human Carcinogen - There is limited evidence of carcinogenicity in animals in the absence of data on humans.

Group D - Not Classified - The evidence for carcinogenicity in animals is inadequate.

Group E - No Evidence of Carcinogenicity to Humans - There is no evidence for carcinogenicity in at least two adequate animal tests in different species, or in both epidemiological and animal studies.

Slope factors and unit risks are developed by the USEPA based on epidemiological or animal bioassay data for a specific route of exposure, either oral or inhalation. For some chemicals, sufficient data are available to develop route-specific slope factors for inhalation and ingestion. For chemicals with only one route-specific slope factor but for which carcinogenic effects may also occur via another route, the available slope factor may be used by the USEPA to evaluate risks associated with several potential routes of exposure (USEPA, 1989b).

A number of the chemicals of potential concern have been classified as carcinogens or potential carcinogens by USEPA, and each of these has also been assigned a carcinogenicity weight-of-evidence category, as shown in Table 6-7. These chemicals are:

Group A - Human Carcinogens

Arsenic
Benzene
Chromium VI
Nickel

Group B - Probable Human Carcinogens

Chloroform
Methylene Chloride
2,4-Dinitrotoluene
3,3'-Dichlorobenzidine
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Carbazole
Chrysene
Dibenz(a,h)anthracene
Indeno(1,2,3-cd)pyrene
N-Nitrosodiphenylamine
Pentachlorophenol
bis(2-Ethylhexyl)phthalate

DDE, 4,4'-
DDD, 4,4'-
DDT, 4,4'-
Aldrin
Aroclor -1254
Aroclor-1260
Dieldrin
Heptachlor
Heptachlor epoxide
Toxaphene
alpha-Chlordane
alpha-BHC
Beryllium
Cadmium
Lead

Group C - Possible Human Carcinogens

1,1,2,2-Tetrachloroethane
Chloromethane
2,4,6-Trinitrotoluene
2-Methylphenol
Butylbenzylphthalate
beta-BHC

All remaining chemicals of concern are either not found to have weight of evidence rankings or are Group D or E. Group D classification means that the data are insufficient to make a determination regarding carcinogenic potential while Group E compounds have been conclusively found to be non-carcinogenic. Chemicals of potential concern found at SEAD 16 with potential carcinogenic effects are shown in Table 6-7 along with their cancer slope factors.

6.4.2.1 Cancer Slope Factors for Oral and Inhalation Exposure

The types of toxicity values used to evaluate the carcinogenic effects of chemicals include slope factors (SFs) for oral exposure, and unit risk factors (URFs) for inhalation exposure. Oral slope factors are reported as risk per dose $(mg/kg\text{-}day)^{-1}$. Inhalation unit risk factors are reported in units of risk per concentration $(mg/m^3)^{-1}$. To make use of the unit risk factors in calculating risks they first had to be converted to inhalation slope factors in units of $(mg/kg\text{-}day)^{-1}$. This conversion was made by assuming an inhalation rate of 20 m^3/day and an adult bodyweight of 70 kg. Thus:

Inhalation slope factor $(mg/kg\text{-}day)^{-1}$

$$UnitRisk\left(\frac{ug}{m^3}\right)^{-1} \times \frac{day}{20m^3} \times 70kg \times \frac{1000ug}{mg}$$

6.4.2.2 Cancer Slope Factors for Dermal Exposure

As discussed above, USEPA has not derived toxicity values for the dermal route of exposure. In the absence of dermal reference toxicity values, USEPA has suggested (USEPA, 1989a) that, in some cases, it is appropriate to modify an oral slope factor so it can be used to estimate the risk incurred by dermal exposure. The oral slope factors were converted to dermal slope factors by dividing by the oral absorption efficiency. The same values presented in Section 6.4.1.2 were used, however, if chemical specific modification factors were unavailable, oral values are used without adjustment. As discussed previously any valuation of the contribution of dermal exposure to the overall risk needs to be viewed as highly tentative at best. This is particularly true for PAH's which are carcinogens at the point of contact, i.e., to skin.

6.4.2.3 Toxic Equivalency Factors

When slope factors and unit risks were not available for all potentially carcinogenic members of a chemical class, toxicity values were calculated using toxicity equivalency factors (TEFs). TEFs are values that compare the carcinogenic potential of a given chemical in a class to the carcinogenic potential of a chemical in the class that has a verified slope factor and/or unit risk. USEPA has provided TEFs for PAHs (USEPA, 1993b). TEF values are as follows:

PAH	TEF
Benzo(a)pyrene	**1.0**
Benzo(a)anthracene	**0.1**
Benzo(b)fluoranthene	**0.1**

Benzo(k)fluoranthene	**0.01**
Dibenzo(a,h)anthracene	**1.0**
Chrysene	**0.001**
Indeno(1,2,3-cd)pyrene	**0.1**

To calculate a slope factor or unit risk for a given PAH the appropriate TEF value is multiplied by the slope factor or unit risk for benzo(a)pyrene.

6.5 RISK CHARACTERIZATION

6.5.1 Introduction

To characterize risk, toxicity and exposure assessments were summarized and integrated into quantitative and qualitative expressions of risk. To characterize potential noncarcinogenic effects, comparisons were made between projected intakes of substances and toxicity values. To characterize potential carcinogenic effects, probabilities that an individual will develop cancer over a lifetime of exposure are estimated from projected intakes and chemical-specific dose-response information. Major assumptions, scientific judgments, and, to the extent possible, estimates of the uncertainties embodied in the assessment are also presented.

6.5.1.1 Noncarcinogenic Effects

The potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time period with an RfD derived for a similar exposure period. This ratio of exposure to toxicity is called a hazard quotient according to the following equation:

$$\textit{Noncancer Hazard Quotient} = E/RfD$$

Where:

E = Exposure level or intake (mg/kg-day), and
RfD = Reference Dose (mg/kg-day)

The noncancer hazard quotient assumes that there is a level of exposure (i.e., an RfD) below which it is unlikely for even sensitive populations to experience adverse health effects. If the exposure level (E) exceeds the threshold (i.e., If E/RfD exceeds unity) there may be concern for potential noncancer effects.

To assess the overall potential for noncarcinogenic effects posed by more than one chemical, a hazard index (HI) approach has been developed by the USEPA. This approach assumes that simultaneous sub-threshold exposures to several chemicals could result in an adverse health effect. It also assumes that the magnitude of the adverse effect will be proportional to the sum of the ratios of the subthreshold exposures to respective acceptable exposures.

This is expressed as:

$$HI = E_1/RfD_1 + E_2/RfD_2 + ... + E_i/RfD_i$$

Where:

E_i = the exposure level or intake of the I
toxicant, and
RfD_i = reference dose for the i^{th} toxicant.

While any single chemical with an exposure level greater that the toxicity value will cause the HI to exceed unity, for multiple chemical exposures, the HI can also exceed unity even if no single chemical exposure exceeds its RfD. The assumption of dose additivity reflected in the HI is best applied to compounds that induce the same effects by the same mechanisms. Applying the HI to cases where the known compounds do not induce the same effect may overestimate the potential for effects. To assess the overall potential for noncarcinogenic effects posed by several exposure pathways, the total HI for chronic exposure is the sum of the HI's for each pathway, for each receptor.

6.5.1.2 Carcinogenic Effects

For carcinogens, risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the potential carcinogen (i.e., excess individual lifetime cancer risk). The slope factor converts estimated daily intakes averaged over a lifetime of exposure directly to incremental risk of an individual developing cancer. It can generally be assumed that the dose-response relationship will be linear in the low-dose portion of the multistage model dose-response curve. Under this assumption, the slope factor is a constant, and risk will be directly related to intake. Thus, the following linear low-dose equation was used in this assessment:

$$Risk = CDI \times SF$$

Where:

Risk = A unitless probability of an individual developing cancer,
CDI = Chronic Daily Intake over 70 years (mg/kg-day), and
SF = Slope Factor $(\text{mg/kg-day})^{-1}$

Because the slope factor is often an upper 95th-percentile confidence limit of the probability of a response and is based on animal data used in the multistage model, the carcinogenic risk will generally be an upper-bound estimate. This means that the "true risk" is not likely to exceed the risk estimate derived through this model and is likely to be less than predicted.

For simultaneous exposure to several carcinogens, the USEPA assumes that the risks are additive. That is to say:

$$\text{Risk}_T = \text{Risk1} + \text{Risk2} + \ldots + \text{Risk}_i$$

Where:

Risk_T = Total cancer risk, expressed as a unitless probability, and
Risk_i = Risk estimate for the ith substance.

Addition of the carcinogenic risks is valid when the following assumptions are met:

doses are low,
no synergistic or antagonistic interactions occur, and
similar endpoints are evaluated.

According to guidance in the National Contingency Plan, the target overall lifetime carcinogenic risks from exposures for determining clean-up levels should range from 10^{-4} to 10^{-6}.

6.5.1.3 Tentatively Identified Compounds

Tables in Section 4 illustrate all TICs found during the phase I and ESI programs at SEAD 16. VOC and semivolatile organic analyses of soil, sediment and surface water samples included tentatively identified compounds (TICs). While VOC TICs were found sporadically, semivolatile TICs were consistently found at total concentrations which often exceeded the total TCL compounds. The TICs consist primarily of unknown compounds and compounds not known to be toxic. It is likely that there is some risk added by the TICs at the site, but this risk is likely not significant when compared to the risk presented by the TCL chemicals.

6.5.2 Summary of Cancer and Noncancer Risks

Tables 6-8 and 6-9 summarize the calculated cancer and noncancer risks for all exposure scenarios considered in this risk assessment. Table 6-8 summarizes the reasonable maximum exposure (RME) scenarios and Table 6-9 summarizes the central tendency (CT) scenarios. The risk calculations for each exposure scenario and exposure route are discussed in the following sections. Tables 6-8 and 6-9 also serve as a guide to tables in Appendix I which show risk calculations for each exposure route.

6.5.3 Current Site Worker

Potential health risks were estimated for the current site worker for exposures via inhalation of ambient air, ingestion of soil and dermal contact with soil. Cancer and non-cancer risk estimates are presented individually for these pathways in Appendix I. Risks from each exposure pathway are discussed below, followed by an overall summary for this scenario.

Inhalation of Particulates in Ambient Air

The cumulative cancer risk from inhalation of airborne particulates is 2×10^{-11} and 3×10^{-12} for the RME and CT, respectively. The non-cancer hazard index is 0.003 and 0.02 for the RME and CT, respectively. These risks for non-cancer and carcinogenic health effects are below the USEPA defined targets.

TABLE 6-8

CALCULATION OF TOTAL NONCARCINOGENIC AND CARCINOGENIC RISKS
REASONABLE MAXIMUM EXPOSURE (RME)
SEAD-16 Remedial Investigation
Seneca Army Depot Activity

RECEPTOR	EXPOSURE ROUTE	EXPOSURE/RISK CALCULATIONS Table Number	HAZARD INDEX	CANCER RISK
CURRENT SITE WORKER	Inhalation of Dust in Ambient Air	Table I-2	3E-02	2E-11
	Ingestion of Onsite Soils	Table I-6	1E-02	1E-06
	Dermal Contact to Onsite Soils	Table I-8	2E-03	3E-08
	TOTAL RECEPTOR RISK (Nc & Car)		*5E-02*	*1E-06*
FUTURE INDUSTRIAL WORKER	Inhalation of Dust in Indoor Air	Table I-4	3E-01	0E+00
	Ingestion of Indoor Dust	Table I-10	2E+01	5E-03
	Dermal Contact to Indoor Dust	Table I-12	2E+00	6E-06
	Ingestion of Groundwater	Table I-20	2E+00	4E-05
	TOTAL RECEPTOR RISK (Nc & Car)		*2E+01*	*5E-03*
FUTURE ON-SITE CONSTRUCTION WORKERS	Inhalation of Dust in Ambient Air	Table I-2	5E-01	9E-11
	Ingestion of Onsite Soils	Table I-6	9E-01	3E-06
	Dermal Contact to Onsite Soils	Table I-8	2E-02	1E-08
	TOTAL RECEPTOR RISK (Nc & Car)		*1E+00*	*3E-06*
FUTURE TRESSPASSER	Inhalation of Dust in Ambient Air	Table I-2	1E-02	2E-12
	Ingestion of Onsite Soils	Table I-6	9E-02	2E-06
	Dermal Contact to Onsite Soils	Table I-8	5E-03	2E-08
	Dermal Contact to Surface Water while Wading	Table I-14	7E-03	8E-07
	Ingestion of Onsite Sediment	Table I-16	2E-01	4E-07
	Dermal Contact to Sediment while Wading	Table I-18	1E-02	3E-08
	TOTAL RECEPTOR RISK (Nc & Car)		*3E-01*	*3E-06*
FUTURE DAY CARE CENTER CHILD	Inhalation of Dust in Ambient Air	Table I-2	8E-01	1E-10
	Ingestion of Onsite Soils	Table I-6	2E+00	4E-05
	Dermal Contact to Onsite Soils	Table I-8	4E-02	1E-07
	Ingestion of Groundwater	Table I-20	4E+00	2E-05
	TOTAL RECEPTOR RISK (Nc & Car)		*6E+00*	*6E-05*
FUTURE DAY CARE CENTER WORKER	Inhalation of Dust in Ambient Air	Table I-2	3E-01	2E-10
	Ingestion of Onsite Soils	Table I-6	2E-01	2E-05
	Dermal Contact to Onsite Soils	Table I-8	2E-02	3E-07
	Ingestion of Groundwater	Table I-20	2E+00	4E-05
	TOTAL RECEPTOR RISK (Nc & Car)		*2E+00*	*6E-05*

TABLE 6-9

CALCULATION OF TOTAL NONCARCINOGENIC AND CARCINOGENIC RISKS
CENTRAL TENDENCY (CT)
SEAD-16 Remedial Investigation
Seneca Army Depot Activity

RECEPTOR	EXPOSURE ROUTE	EXPOSURE/RISK CALCULATIONS Table Number	HAZARD INDEX	CANCER RISK
CURRENT SITE WORKER	**Inhalation of Dust in Ambient Air**	Table I-3	**2E-02**	**3E-12**
	Ingestion of Onsite Soils	Table I-7	**3E-03**	**9E-08**
	Dermal Contact to Onsite Soils	Table I-9	**2E-04**	**7E-10**
	TOTAL RECEPTOR RISK (Nc & Car)		***2E-02***	***9E-08***
FUTURE INDUSTRIAL WORKER	**Inhalation of Dust in Indoor Air**	Table I-5	**3E-01**	**0E+00**
	Ingestion of Indoor Dust	Table I-11	**7E+00**	**6E-04**
	Dermal Contact to Indoor Dust	Table I-13	**3E-01**	**3E-07**
	Ingestion of Groundwater	Table I-21	**1E+00**	**1E-05**
	TOTAL RECEPTOR RISK (Nc & Car)		***9E+00***	***6E-04***
FUTURE ON-SITE CONSTRUCTION WORKERS	**Inhalation of Dust in Ambient Air**	Table I-3	**4E-01**	**7E-11**
	Ingestion of Onsite Soils	Table I-7	**2E-01**	**6E-07**
	Dermal Contact to Onsite Soils	Table I-9	**4E-03**	**2E-09**
	TOTAL RECEPTOR RISK (Nc & Car)		***6E-01***	***6E-07***
FUTURE TRESSPASSER	**Inhalation of Dust in Ambient Air**	Table I-3	**7E-03**	**2E-13**
	Ingestion of Onsite Soils	Table I-7	**2E-02**	**9E-08**
	Dermal Contact to Onsite Soils	Table I-9	**4E-04**	**3E-10**
	Dermal Contact to Surface Water while Wading	Table I-15	**3E-03**	**6E-08**
	Ingestion of Onsite Sediment	Table I-17	**5E-02**	**2E-08**
	Dermal Contact to Sediment while Wading	Table I-19	**1E-03**	**5E-10**
	TOTAL RECEPTOR RISK (Nc & Car)		***9E-02***	***2E-07***
FUTURE DAY CARE CENTER CHILD	**Inhalation of Dust in Ambient Air**	Table I-3	**7E-01**	**5E-11**
	Ingestion of Onsite Soils	Table I-7	**7E-01**	**8E-06**
	Dermal Contact to Onsite Soils	Table I-9	**6E-03**	**1E-08**
	Ingestion of Groundwater	Table I-21	**3E+00**	**1E-05**
	TOTAL RECEPTOR RISK (Nc & Car)		***5E+00***	***2E-05***
FUTURE DAY CARE CENTER WORKER	**Inhalation of Dust in Ambient Air**	Table I-3	**3E-01**	**5E-11**
	Ingestion of Onsite Soils	Table I-7	**7E-02**	**2E-06**
	Dermal Contact to Onsite Soils	Table I-9	**3E-03**	**1E-08**
	Ingestion of Groundwater	Table I-21	**1E+00**	**1E-05**
	TOTAL RECEPTOR RISK (Nc & Car)		***2E+00***	***1E-05***

Ingestion of Soil

The cumulative cancer risk from ingestion of soil is 1 x 10^{-6} and 9 x 10^{-8} for the RME and CT, respectively. The non-cancer hazard index is 0.01 and 0.003 for the RME and CT, respectively. These risks for non-cancer and carcinogenic health effects are below the USEPA defined targets.

Dermal Contact with Soil

The cumulative cancer risk from dermal contact with soil is 3 x 10^{-8} and 7 x 10^{-10} for the RME and CT, respectively. The non-cancer hazard index is 0.002 and 0.0002 for the RME and CT, respectively. These risks for non-cancer and carcinogenic health effects are below the USEPA defined targets.

Current Site Worker Summary

The cumulative lifetime cancer risk from all pathways is 1 x 10^{-6} (RME) and 9 x 10^{-8} (CT). These risks are within or below the USEPA target range of 10^{-6} to 10^{-4}. The cumulative non-cancer hazard index from all pathways is 0.05 (RME) and 0.02 (CT). This hazard index is also below the USEPA target of 1.0.

6.5.4 Future Industrial Worker

Potential health risks were estimated for the future industrial worker for exposures via inhalation of indoor air, ingestion of indoor surface dust, dermal contact with indoor surface dust and ingestion of groundwater. Cancer and non-cancer risk estimates are presented individually for these pathways in Appendix I. Risks from each exposure pathway are discussed below, followed by an overall summary for this scenario.

Inhalation of Particulates in Indoor Air

There was no calculated cancer risk from inhalation of airborne particulates (no carcinogens were detected in any indoor air samples). The non-cancer hazard index is 0.03 for both the RME and CT. These risks for non-cancer and carcinogenic health effects are below the USEPA defined targets.

Ingestion of Surface Dust

The cumulative cancer risk from ingestion of indoor surface dust is 5 x 10^{-3} and 6 x 10^{-4} for the RME and CT, respectively. The non-cancer hazard index is 20 and 7 for the RME and CT, respectively. This pathway is the primary contributor of both cancer and non-cancer risk for the future industrial worker. 2-4 dinitrotoluene is the predominant carcinogen, responsible for nearly all of the estimated risk for the RME. Two compounds, 2,4-dinitrotoluene and antimony are the major contributors to the hazard index [RME HQ = 9 and 4, respectively].

Dermal Contact with Surface Dust

The cumulative cancer risk from dermal contact with indoor surface dust is 6 x 10^{-6} and 3 x 10^{-7} for the RME and CT, respectively. The non-cancer hazard index is 2 and 0.3 for the RME and CT, respectively. The non-cancer risks are due primarily to cadmium.

Ingestion of Groundwater

The cumulative cancer risk from ingestion of groundwater is 4 x 10^{-5} and 1 x 10^{-5} for the RME and CT, respectively. The non-cancer hazard index is 2 and 1 for the RME and CT, respectively. Thallium is the predominant contributor to the hazard index [RME HQ = 2].

Future Industrial Worker Summary

The cumulative lifetime cancer risk from all pathways is 5 x 10^{-3} (RME) and 6 x 10^{-4} (CT). These risks exceed the USEPA target range of 10^{-6} to 10^{-4}. The cumulative non-cancer hazard index from all pathways is 20 (RME) and 8 (CT). This hazard index exceeds the USEPA target of 1.0. This result indicates that continuous worker occupancy of the former deactivation furnace building is unacceptable in its current state.

6.5.5 Future Construction Worker

Potential health risks were estimated for the future construction worker for exposures via inhalation of ambient air, ingestion of soil and dermal contact with soil. Cancer and non-cancer risk estimates are presented individually for these pathways in Appendix I. Risks from each exposure pathway are discussed below, followed by an overall summary for this scenario.

Inhalation of Particulates in Ambient Air

The cumulative cancer risk from inhalation of airborne particulates is 9×10^{-11} and 7×10^{-11} for the RME and CT, respectively. The non-cancer hazard index is 0.5 and 0.4 for the RME and CT, respectively. These risks for non-cancer and carcinogenic health effects are below the USEPA defined targets.

Ingestion of Soil

The cumulative cancer risk from ingestion of soil is 3×10^{-6} and 6×10^{-7} for the RME and CT, respectively. The non-cancer hazard index is 0.9 and 0.02 for the RME and CT, respectively. These risks for non-cancer and carcinogenic health effects are below the USEPA defined targets.

Dermal Contact with Soil

The cumulative cancer risk from dermal contact with soil is 1×10^{-8} and 2×10^{-9} for the RME and CT, respectively. The non-cancer hazard index is 0.02 and 0.004 for the RME and CT, respectively. These risks for non-cancer and carcinogenic health effects are below the USEPA defined targets.

Future Construction Worker Summary

The cumulative lifetime cancer risk from all pathways is 3×10^{-6} (RME) and 6×10^{-7} (CT). These risks are within or below the USEPA target range of 10^{-6} to 10^{-4}. The cumulative non-cancer hazard index from all pathways is 1 (RME) and 0.6 (CT). The RME hazard index is above the USEPA target of 1.0, while the CT hazard index is slightly below.

6.5.6 Future Trespasser

Potential health risks were estimated for the future adolescent trespasser for exposures via inhalation of ambient air, ingestion of surface soil, dermal contact with surface soil, dermal contact with surface water, ingestion of sediment, and dermal contact with sediment. Cancer and non-cancer risk estimates are presented individually for these pathways in Appendix I. Risks from each exposure pathway are discussed below, followed by an overall summary for this scenario.

Inhalation of Particulates in Ambient Air

The cumulative cancer risk from inhalation of airborne particulates is 2 x 10^{-12} and 2 x 10^{-13} for the RME and CT, respectively. The non-cancer hazard index is 0.01 and 0.007 for the RME and CT, respectively. This pathway does not contribute significantly to either the overall cancer or non-cancer risk for the future trespasser.

Ingestion of Soil

The cumulative cancer risk from ingestion of surface soil is 2 x 10^{-6} and 9 x 10^{-8} for the RME and CT, respectively. The non-cancer hazard index is 0.09 and 0.02 for the RME and CT, respectively. These risks for non-cancer and carcinogenic health effects are below the USEPA defined targets.

Dermal Contact with Soil

The cumulative cancer risk from dermal contact with surface soil is 2x 10^{-8} and 3 x 10^{-10} for the RME and CT, respectively. The non-cancer hazard index is 0.005 and 0.0004 for the RME and CT, respectively. These risks for non-cancer and carcinogenic health effects are below the USEPA defined targets.

Dermal Contact with Surface Water

The cumulative cancer risk from dermal contact with surface water is 8 x 10^{-7} and 6 x 10^{-8} for the RME and CT, respectively. The non-cancer hazard index is 0.007 and 0.003 for the RME and CT, respectively. These risks for non-cancer and carcinogenic health effects are below the USEPA defined targets.

Ingestion of Sediment

The cumulative cancer risk from ingestion of sediment is 4 x 10^{-7} and 2 x 10^{-8} for the RME and CT, respectively. The non-cancer hazard index is 0.2 and 0.05 for the RME and CT, respectively. These risks for non-cancer and carcinogenic health effects are below the USEPA defined targets.

Dermal Contact with Sediment

The cumulative cancer risk from dermal contact with sediment is 3 x 10^{-8} and 5 x 10^{-10} for the RME and CT, respectively. The non-cancer hazard index is 0.01 and 0.001 for the RME and CT, respectively. This pathway does not contribute significantly to either overall cancer or non-cancer risks for the future trespasser.

Future Trespasser Summary

The cumulative lifetime cancer risk from all pathways is 3 x 10^{-6} (RME) and 2 x 10^{-7} (CT). These risks are within or below the USEPA target range of 10^{-6} to 10^{-4}. The cumulative non-cancer hazard index from all pathways is 0.3 (RME) and 0.09 (CT). This hazard index is also below the USEPA target of 1.0.

6.5.7 Future Day Care Center Child

Potential health risks were estimated for the future day care center child for exposures via inhalation of ambient air, ingestion of soil, dermal contact with soil, and ingestion of groundwater. Cancer and non-cancer risk estimates are presented individually for these pathways in Appendix I. Risks from each exposure pathway are discussed below, followed by an overall summary for this scenario.

Inhalation of Particulates in Ambient Air

The cumulative cancer risk from inhalation of airborne particulates is 1 x 10^{-10} and 5 x 10^{-11} for the RME and CT, respectively. The non-cancer hazard index is 0.8 and 0.7 for the RME and CT, respectively. These risks for carcinogenic and non-cancer health effects are below USEPA defined targets.

Ingestion of Soil

The cumulative cancer risk from ingestion of soil is 4 x 10^{-5} and 8 x 10^{-6} for the RME and CT, respectively. The non-cancer hazard index is 2 and 0.7 for the RME and CT, respectively. This pathway is a significant contributor of non-cancer risk for the future day care center child. Antimony is the predominant contributor to the hazard index [RME HQ = 1].

Dermal Contact with Soil

The cumulative cancer risk from dermal contact with soil is 1 x 10^{-7} and 1 x 10^{-8} for the RME and CT, respectively. The non-cancer hazard index is 0.04 and 0.006 for the RME and CT, respectively. These risks for carcinogenic and non-cancer health effects are below USEPA defined targets.

Ingestion of Groundwater

The cumulative cancer risk from ingestion of groundwater is 2 x 10^{-5} and 1 x 10^{-5} for the RME and CT, respectively. The non-cancer hazard index is 4 and 3 for the RME and CT, respectively. This pathway is a significant contributor of non-cancer risk for the future day care center child. Thallium is the predominant contributor to the hazard index [RME HQ = 4].

Future Day Care Center Child Summary

The cumulative lifetime cancer risk from all pathways is 6 x 10^{-5} (RME) and 2 x 10^{-5} (CT). These risks are within the USEPA target range of 10^{-6} to 10^{-4}. The cumulative non-cancer hazard index from all pathways is 4 (RME) and 3 (CT). This hazard index exceeds the USEPA target of 1.0.

6.5.8 Future Day Care Center Worker

Potential health risks were estimated for the future day care center worker for exposures via inhalation of ambient air, ingestion of soil, dermal contact with soil, and ingestion of groundwater. Cancer and non-cancer risk estimates are presented individually for these pathways in Appendix I. Risks from each exposure pathway are discussed below, followed by an overall summary for this scenario.

Inhalation of Particulates in Ambient Air

The cumulative cancer risk from inhalation of airborne particulates is 2 x 10^{-10} and 5 x 10^{-11} for the RME and CT, respectively. The non-cancer hazard index is 0.3 for both the RME and CT. These risks for carcinogenic and non-cancer health effects are below USEPA defined targets.

Ingestion of Soil

The cumulative cancer risk from ingestion of soil is 2 x 10^{-5} and 2 x 10^{-6} for the RME and CT, respectively. The non-cancer hazard index is 0.2 and 0.07 for the RME and CT, respectively. These risks for carcinogenic and non-cancer health effects are below USEPA defined targets.

Dermal Contact with Soil

The cumulative cancer risk from dermal contact with soil is 3 x 10^{-7} and 1 x 10^{-8} for the RME and CT, respectively. The non-cancer hazard index is 0.02 and 0.003 for the RME and CT, respectively. These risks for carcinogenic and non-cancer health effects are below USEPA defined targets.

Ingestion of Groundwater

The cumulative cancer risk from ingestion of groundwater is 4 x 10^{-5} and 1 x 10^{-5} for the RME and CT, respectively. The non-cancer hazard index is 2 and 1 for the RME and CT, respectively. Thallium is the predominant contributor to the hazard index [RME HQ = 2].

Future Day Care Center Worker Summary

The cumulative lifetime cancer risk from all pathways is 6 x 10^{-5} (RME) and 1 x 10^{-5} (CT). These risks are within the USEPA target range of 10^{-6} to 10^{-4}. The cumulative non-cancer hazard index from all pathways is 2 for both the RME and CT. This hazard index exceeds the USEPA target of 1.0.

6.5.9 Risk Characterization for Lead

The previous analyses of the current and future land use exposure scenarios do not include any quantification of risk for lead since no approved RfD, RfC, slope factor or inhalation unit risk currently are available. Lead was consistently detected at SEAD-16 in all media. This section qualitatively addresses the risk from lead exposure at SEAD-16.

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, which are not part of the current site users.

Young and developing humans are highly sensitive to its effects. Also, young children are prone to ingest more lead as a result of normal mouthing behavior. Decreased IQ and reduced growth may result from childhood exposure. Fetal exposure may result in preterm birth, reduced birth weight, and decreased IQ. Some of the health effects of lead, particularly changes in the levels of certain blood enzymes and in aspects of children's neurobehavioral development, may occur at blood levels so low as to be essentially without a threshold.

Lead exposures 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 to the male reproductive system. The USEPA currently does not provide any toxicity values for lead. The USEPA has placed lead in weight-of-evidence Group B2, indicating that it is a probable human carcinogen.

USEPA has developed different approaches for assessing risks from adult and child exposure to lead. To address adult exposures, EPA issued "Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil" (USEPA, December 1996). To address child exposures, EPA recommends use of the Integrated Exposure Uptake Biokinetic Model for Lead (Version 0.99), and the associated "Guidance Manual for the Integrated Integrated Exposure Uptake Biokinetic Model for Lead in Children" (USEPA, February 1994). The analysis of potential risk from exposure to lead at SEAD 16 follows these recommendations for adult and child exposures, respectively.

Child Day Care Center Exposure

USEPA and the Centers for Disease Control and Prevention have determined that blood lead levels as low as 10-15 ug/dL in infants or young children indicate an increased risk of irreversible neurobehavioral deficits (Federal Register, 1988). Where young children may be consistently exposed to lead, such as in a residential scenario, risk may be calculated using the Integrated Exposure Uptake Biokinetic Model (IEUBK) which predicts the blood lead concentrations in children exposed to lead through a variety of media. The model is designed to estimate blood lead levels using a combination of default assumptions and site-specific exposure information where available. The model contains two modules: uptake and biokinetic. The uptake module estimates the quantity of lead taken into the body (uptake) from exposure to lead in five media (air, drinking water, soil/dust, food and paint). The biokinetic module estimates the distribution of this lead among various bodily organs and, most importantly, in the blood.

The IEUBK model calculates a child's uptake and blood lead levels assuming a constant daily exposure in each of several environmental media (air, soil, etc.). The model includes default values for many exposure parameters which change by age, to realistically reflect growth changes in a child (e.g. different inhalation rates and drinking water intakes). The default values used in IEUBK model are based on nationwide surveys of lead distribution in the environment and studies of inhalation and ingestion for each age group modeled (children age 0-7). For the IEUBK simulations performed for this risk assessment, the default values were used for most input parameters.

The IEUBK model was used to estimate the risk associated with a child's ingestion of soil and groundwater while attending a day care center located at SEAD 16. To simulate this scenario, we assumed that a child was exposed to SEAD 16 soil and groundwater five days per week. The IEUBK model contains default values for soil ingestion rates based on daily (i.e., seven days per week) exposure. These values were multiplied by 5/7 to reflect exposure only at the day care center. This calculation assumes that on the other two days per week the child has no lead exposure from soil ingestion.

The IEUBK model includes default assumptions regarding indoor dust ingestion rates and lead concentrations. The IEUBK manual recommends that indoor dust be assumed to have a lead concentration equal to 70% of the soil concentration, and that soil represents 45% of the total soil plus dust ingestion rate. These default assumptions were used.

The child is potentially exposed to lead via other pathways. The IEUBK model includes default exposures for lead in air and diet. The recommended default values were used for all non-soil/dust/groundwater exposures.

The IEUBK model parameter input values used for this assessment are summarized in Table K-1 in Appendix K.

Two day care exposure simulations were performed for this assessment. First, the IEUBK model was run to calculate the median blood lead levels at each age for a child exposed to the levels of lead found in soil and groundwater at this site. Second, the model was run to derive an example allowable soil lead concentration following the approach used by USEPA in deriving a target lead concentration for residential soil, in the Office of Solid Waste and Emergency Response (OSWER) Interim Directive #9355.4-12 titled "Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities" (USEPA, August 1994). The IEUBK model output for each simulation is shown in Appendix K. The results of these analyses are discussed below.

Day Care Scenario Based on Current Lead Concentrations. Day care center scenario ingestion of soil and groundwater at the current SEAD 16 average lead concentrations (3790 mg/kg in soil and 6.4 ug/L in groundwater) is estimated to cause median blood lead levels in children which exceed 10 ug/dL, as shown in Figure 6-4.

Example Allowable Soil Lead Concentration. In the Interim Directive document, EPA derived a target lead concentration of 400 ppm lead in soil, based on its IEUBK model simulation. This simulation, which included default assumptions for all exposure pathways, estimated that with residential exposure to soil containing 400 ppm of soil, a child has a 95% probability of having a blood lead level less than 10 ug/dL. A similar calculation was performed for this assessment based on the day care center soil ingestion scenario, as described above. For this day care center scenario, the IEUBK model predicts a 95% probability of having a blood lead level less than 10 ug/dL at a soil lead concentration of 625 ppm.

Figures 6-5 and 6-6 illustrate the IEUBK model results. Figure 6-5 is a plot of the cumulative probability distribution for exceeding 10 ug/dL lead in blood, associated with day care exposure to an average concentration of 625 ppm lead in soil. This plot shows that the probability of exceeding 10 ug/dL is 5%. Figure 6-6 shows the median blood lead levels at each age predicted for day care exposure to 625 ppm lead in soil. This figure also shows the IEUBK predictions for EPA's residential scenario target level of 400 ppm lead in soil. It can be seen that the results for the day care scenario and EPA's residential scenario are nearly identical. This result indicates that a target average concentration of 625 ppm lead in soil for day care exposure is consistent with EPA's residential target concentration and equally health-protective.

Adult Occupational Exposure

To qualitatively assess risks from adult occupational lead exposure, the site concentrations are compared with risk-based remediation goals (RBRGs) presented in "Recommendations of the

Figure 6-4
IEUBK Model Results
SEAD 16 Day Care Scenario

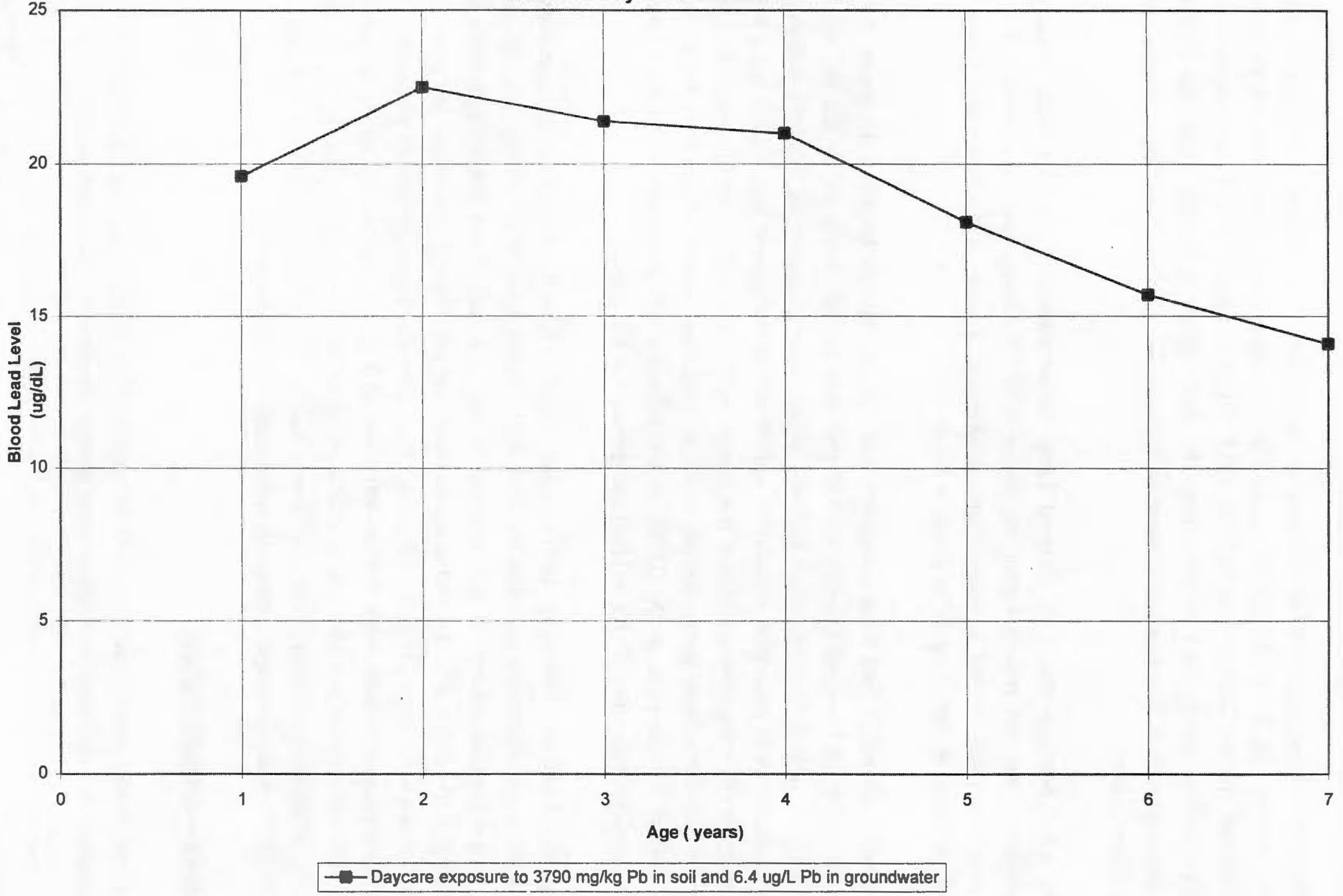


Figure 6-5
IEUBK Model Results
Example Allowable Soil Pb Concentration for Day Care Scenario
Cumulative Probability Plot of Blood Lead Concentration

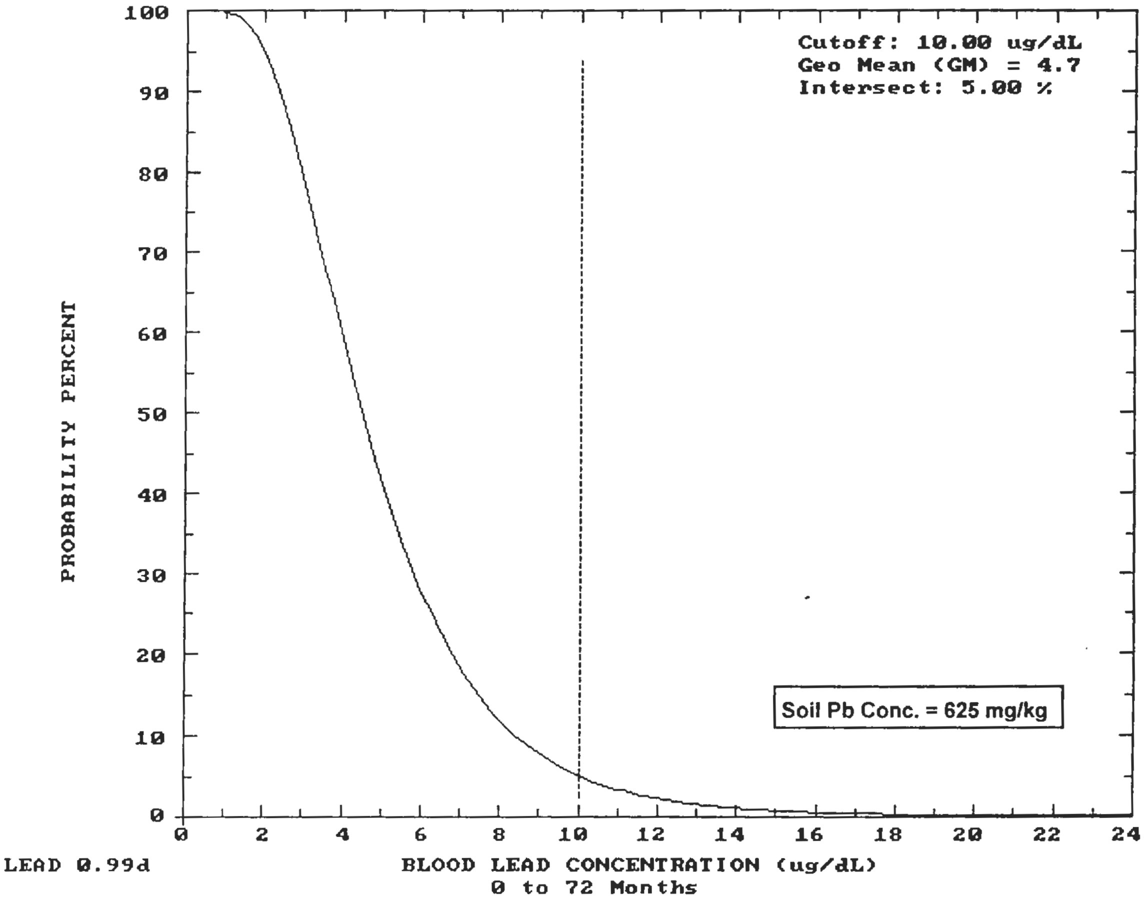
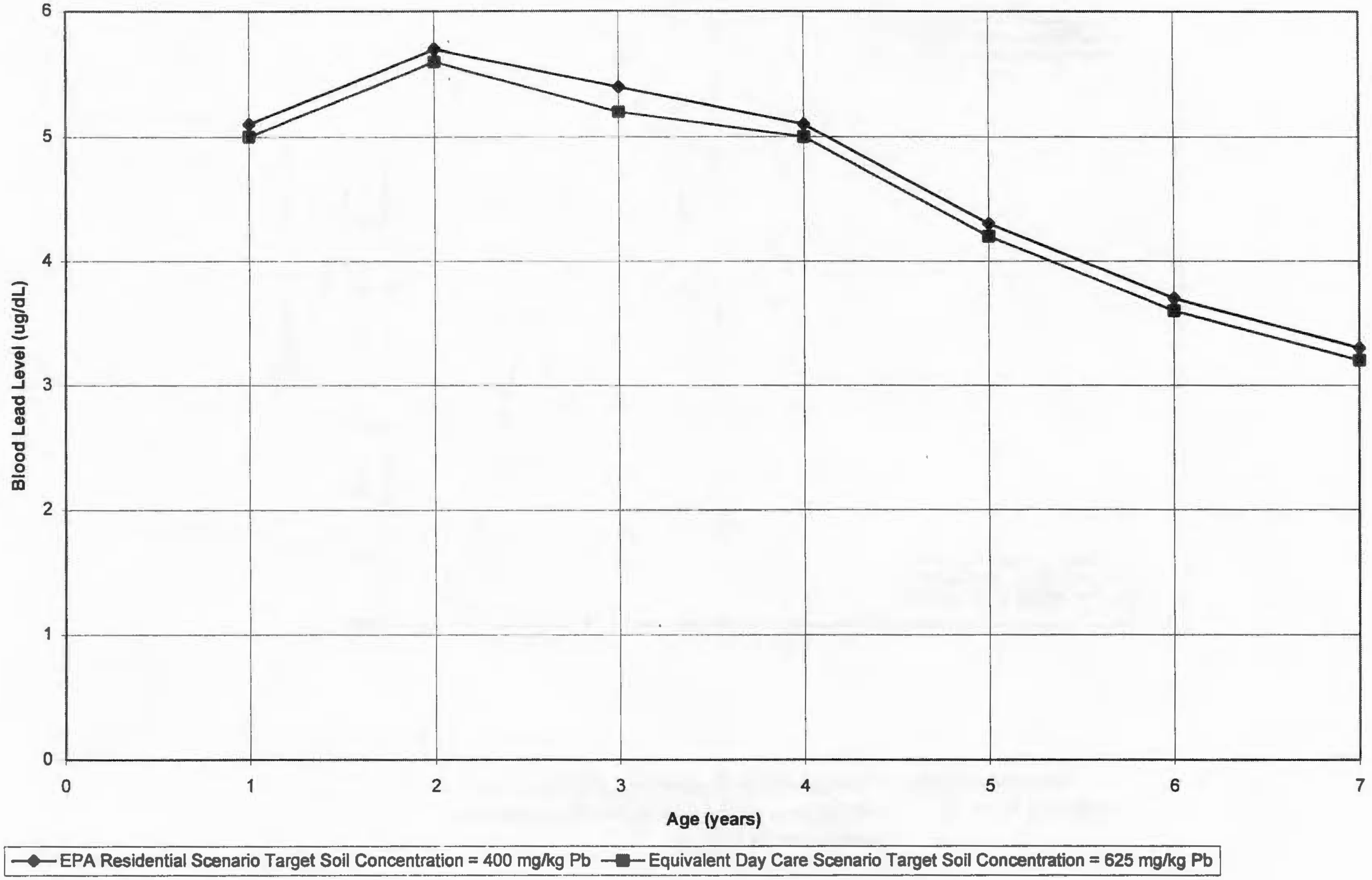


Figure 6-6
IEUBK Model Results
Comparison of Example Day Care Scenario with EPA Residential Scenario Target Soil Levels



Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil" (USEPA, December 1996). In this report, EPA presents a model to calculate target soil concentrations of lead (RBRGs) at which the exposure for a women of child-bearing age would minimize risk to her fetus. Thus, while adult exposure is addressed by EPA's analysis, the most sensitive receptor (i.e., the fetus) is being protected.

EPA has calculated RBRGs for lead in soil using their recommended default parameters as inputs to the model. For a homogeneous, non-urban population exposed for 219 days per year, EPA suggests an RBRG of 1750 mg/kg lead in soil.

As shown in Table 6-3, the average concentrations for lead in surface soil, total soils and sediment range from 1,460 to 4,030 mg/kg, which exceeds the EPA recommended target range of 750 mg/kg to 1,750 mg/kg discussed above. The EPC for solids inside building S-311 is 527,000 mg/kg. The EPC for indoor air, also shown in Table 6-3 is 0.055 ug/m^3 while the highest outdoor air EPC is 1.0 ug/m^3. These values are lower than the National Ambient Air Quality Standard for lead, which is 1.5 ug/m^3 (based on a 3-month average).

These results suggest that lead may pose a health risk upon regular exposure to the site soils or indoor solids, but not from inhalation. The most susceptible receptors would be the future industrial worker, the future construction worker, and future day care chi[illegible].

6.5.10 Uncertainty Assessment

All risk assessments involve the use of assumptions, judgments, and imperfect data to varying degrees. This results in uncertainty in the final estimates of risk. There are uncertainties associated with each component of the risk assessment from data collection through risk characterization. For example, there is uncertainty in the initial selection of substances used to characterize exposures and risk on the basis of the sampling data and available toxicity information. Other sources of uncertainty are inherent in the toxicity values for each substance and the exposure assessments used to characterize risk. Finally, additional uncertainties are incorporated into the risk assessment when exposures to several substances across multiple pathways are summed. Areas of uncertainty in each risk assessment step are discussed below.

6.5.10.1 Uncertainty in Data Collection and Evaluation

Uncertainties in the data collection/evaluation step of the risk assessment focus on determining whether enough samples were collected to adequately characterize the risk, and if sample analyses were conducted in a qualified manner to maximize the confidence in the results. Results of the sample analyses were used to develop a database which includes a complete list of the chemicals by media and their representative concentrations used in the risk assessment. The sampling and analysis was part of the comprehensive RI effort and addressed various objectives in addition to the risk assessment. Therefore, the samples were not collected randomly but were collected from areas of the site known to be contaminated. This type of non-random sampling biases the data collected toward overestimating chemical concentrations from the site. The judgmental bias in the sample collection also limits the applicability of statistics to the database. Because the statistics used to calculate the upper limit of the 95th-percentile confidence interval assume that the data represents a randomly distributed population, and the database does not, there is inherent uncertainty in the application of statistics. Collection of non-random, judgmental samples was necessary to adequately characterize the nature and extent of contamination which is an objective of the RI.

All chemicals detected that were potentially site-related were retained in this assessment. Chemicals that were never detected were eliminated from the assessment. This practice may slightly underestimate risks due to low levels (i.e., below the sample quantitation limit) of eliminated chemicals. Since samples were collected at areas where concentrations were expected to be high, it is very unlikely that any chemicals were present at the site at health-significant levels and not detected in at least one sample. However, if this did occur, this assumption will underestimate risk. The 95th UCLs were used to calculate site-related risks. Since that assumption implies chronic exposure to the 95th UCL concentration, this assumption is likely to overestimate risk.

If a chemical was detected, it was retained in the risk assessment regardless of how frequently it was detected. To calculate the upper limit of the 95th-percentile confidence interval, chemicals were assumed to be present in all samples in a media. When the chemical was not detected in a sample, one-half of the SQL was used. Especially for chemicals that were detected in only a few samples, the upper limit of the 95th-percentile confidence interval probably greatly overestimates the amount of the chemical present and, consequently, the risk from the chemical.

RAGS guidance (USEPA, 1989a) states that if a small number of TICs are present relative to TCL compounds, they can be eliminated in the risk assessment. This process has the possibility of underestimating risk.

The database also includes a number of data validation flags, indicating uncertainty in the reliability of the performance of the analyses done by the laboratory. Flagged data were retained following RAGS guidance.

6.5.10.2 Uncertainty in Exposure Assessment

There are inherent uncertainties in predicting future land uses and future chemical concentrations. Future land use scenarios were based on current plans for redevelopment of this portion of SEDA. Current land uses were identified by characterizing the site's physical setting.

A large part of the risk assessment is the estimation of risks for a broad set of exposure scenarios and pathways. If exposure does not occur, no risks are present. This assessment does not factor in the probability of the exposure occurring. For certain pathways, exposure may be extremely unlikely. For example, the future industrial worker is assumed to occupy building S-311 in its present condition. It is unlikely that this building will be used “as is” without some renovation. This assumption yields an overestimate of risk for this scenario.

Once pathways are identified, exposure point concentrations must be estimated. There is always some doubt as to how well an exposure model approximates the actual conditions receptors will be exposed to at a given site. Key assumptions in estimating exposure point concentrations and exposure assumptions and their potential impact on the assessment are described in the following paragraphs.

As summarized in Table 6-5, there are many factors which determine the level of exposure for each exposure pathway. These factors include inhalation rates, ingestion rates, exposure frequencies, exposure durations, body weight, etc. The values for these exposure factors must be selected by the risk assessor to represent each receptor. For the RME scenarios particularly, upper bound values were selected for each exposure factor. In the calculations of RME exposure, these multiple upper-bound exposure factor estimates compound to yield intakes and absorbed doses which overestimate likely exposure levels.

There is further uncertainty in the quantitative dermal exposure assessments for soil and sediment, since these assessments have been limited to just five compounds with credible dermal absorption factors. Many other compounds were measured in soil and sediment which might be absorbed through the skin, although reliable quantitative absorption factors are not available. Ignoring this larger group of chemicals results in quantitative exposure estimates (absorbed doses) which underestimate the true potential exposures from dermal contact. Consequently, any risk associated with these compounds is also underestimated.

There is also uncertainty associated with using oral toxicity values to calculate dermal risks. As seen in the literature, there are differences between oral and inhalation absorption efficiencies. These differences vary and will likely cause either underestimation or overestimation of dermal risks. The efficiencies are generally within 1 order of magnitude of each other, so the uncertainty introduced is less than 1 order of magnitude.

The EPCs derived from the measured chemical concentrations are assumed to persist without change for the entire duration of each exposure scenario. It is likely that some degradation would occur over time, particularly for some of the organic compounds, that would reduce the current concentrations. Therefore, this steady state assumption tends to overestimate exposure levels.

6.5.10.3 Uncertainty in Toxicity Assessment

Of the chemicals of potential concern, a number had no reference dose or slope factors. They are:

- acenaphthylene
- dibenzofuran
- phenanthrene
- benzo(g,h,i)perylene
- calcium
- cobalt
- lead
- magnesium
- potassium
- sodium
- Endrin Aldehyde

- Endrin Ketone
- delta-BHC
- dichloroprop
- 2-amino 4,6-dinitrotoluene
- 3-nitroaniline
- 4-nitroaniline

Several of these compounds have toxicity information such as weight of evidence classification indicating a strong potential for adverse health effects, particularly lead. The absence of toxicity values of these chemicals tends to underestimate risks.

For chromium, the valence state (e.g., III or VI) was not specifically determined. The toxicity assessment assumed all chromium to be in the Chromium VI valence state, which is the more toxic. This assumption most likely results in an overstatement of risk.

There is considerable uncertainty inherent in the toxicity values for both carcinogens and noncarcinogens. Many of the studies are based on animals and extrapolated to humans, and in some cases, subchronic studies must be used to assess chronic effects. Most cancer slope factors are calculated using a model which extrapolates low dose effects from high dose animal studies. Because toxicity constants are generally based on the upper limit of the 95th-percentile confidence interval or incorporate safety factors to compensate for uncertainty, chemical-specific risks may be overestimated.

Toxicity information was not available for dermal exposure; hence, several assumptions had to be made which may tend to over- or underestimate risk. Oral toxicity values were used without adjustment to calculate risks from dermal exposure because the USEPA has not derived toxicity values for this route of exposure. However, values found in the literature (Owen, 1990) indicate that the uncertainty associated with using oral absorption to estimate dermal absorption is likely less than one order of magnitude. This is due to the lack of scientific studies available to quantify dermal toxicity and carcinogenic potential for the vast majority of priority pollutants and because chemical specific information needed to convert ingested dose to absorbed dose is not available.

6.5.10.4 Uncertainty in Risk Characterization

Uncertainties in the toxicity assessment are compounded under the assumption of dose additivity for multiple substance exposure. That assumption ignores possible synergism's and antagonisms among chemicals, and assumes similarity in mechanisms of action and metabolism. Synergism is the amplification of one chemical's toxic effect by the presence of a second chemical. For example, it is known that smokers also exposed to asbestos have higher lung cancer incidence than either smokers or asbestos workers alone. Ignoring synergism to the extent that it may occur at environmental levels tends to underestimate risk. Antagonism is the reduction of one chemical's toxic effect by the presence of a second chemical. For example, certain foods (such as broccoli) contain chemicals believed to be anticarcinogenic. Ignoring antagonism tends to overestimate risk. Risks summed for chemicals having various weight-of-evidence classifications as well as different target organs may also tend to overestimate risk.

6.5.10.5 Central Tendency Risk

In addition to the RME risks detailed in previous sections, central tendency risks were calculated for the exposure scenarios. These results are summarized in Table 6-9. As described by EPA, the central tendency risk approximates the arithmetic mean or median risk, as opposed to the RME risk which describes exposures above the 90th percentile of the population distribution.

The central tendency risk is calculated by replacing some of the 95th percentile exposure parameters with 50th percentile or median values. For example, the 95th percentile value for employment at a single workplace, 25 years, is replaced by a more typical value of 7 years. Other values are replaced as described in the EPA guidance.

The central tendency risk, when compared to the RME risk helps to illustrate the uncertainty inherent in calculating only the RME risks. A comparison of Table 6-8 to 6-9 indicates that the central tendency HI's are about 30% to 90% of the RME HI's and the central tendency cancer risks are <10% to 33% of the RME risks.

6.6 ECOLOGICAL RISK ASSESSMENT (ERA)

6.6.1 Objectives and Overview

In addition to the evaluation of human health, the BRA also must consider the risk posed by the site to the environment. The requirement for an evaluation of environmental risk to the ecological communities at this site is described in CERCLA, as amended by the Superfund Amendments and Reauthorization Act (SARA), in 40 CFR 300.430 (d),(4); and the New York Rules for Inactive Hazardous Waste Disposal Sites, Title 6, Chapter 4, Subchapter B, Part 375, Subpart 375-1.4. Environmental risk is evaluated through the process of an Ecological Risk Assessment (ERA). Through this authority, the EPA and NYSDEC seek to protect wildlife, fisheries, endangered and threatened species, and critical habitats. These statutes also require that remedial actions selected for National Priorities List (NPL) sites be sufficient to protect both human health and the environment. This requires establishing the baseline of current site conditions that will be used as the basis of comparison in determining the degree that a remedial action will be protective of human health and the environment. This ERA is intended to establish this baseline of ecological site conditions and has been conducted and presented in parallel with the human health risk assessment in fulfillment of the requirements of CERCLA.

As preceding sections of this RI have indicated, a substantial site-specific database of chemical and physical information was developed to characterize the types, locations, and concentrations of chemicals in soil, sediment, surface water, and groundwater. Physical media samples were collected upgradient and downgradient from the site, and from on-site and off-site (for soils) background reference stations. Qualitative characterization of the ecological communities was performed to determine the ecological community at the site.

The ERA addresses potentially significant risks to the following biological groups and special-interest resources associated with the site: vascular vegetation, wildlife, aquatic life, endangered and threatened species, and wetlands. The focus of the ERA at SEAD-16 lies in the area of the Abandoned Deactivation Furnace and the immediately surrounding vicinity. The Abandoned Deactivation Furnace has been evaluated as a single site, with references being made to specific locations when it is appropriate. The aquatic study area included intermittent and perennial drainage ditches at the Abandoned Deactivation Furnace. The terrestrial study area included the Abandoned Deactivation Furnace and the area within a radius of approximately 2 miles from the site perimeter. Within the 2-mile radius, significant resources such as NYSDEC significant habitats; habitats supporting endangered, threatened, and rare species; species of concern; and state-regulated wetlands were identified. Within a smaller 0.5-mile radius of the site perimeter, the major vegetative communities, wildlife species associated with each cover type, and the value of the habitats to the associated wildlife were identified.

The purpose of the ERA component of the BRA is to evaluate the likelihood that adverse ecological effects are occurring or may occur as a result of exposure to chemicals associated with the site based on a weight-of-evidence approach. An ecological risk does not exist unless a given contaminant has the ability to cause one or more adverse effects and it either co-occurs with, or is contacted by, an ecological receptor for a sufficient length of time, or at a sufficient intensity to elicit the identified adverse effect(s) (EPA, 1994b).

The methodology used in this assessment was based on and complies with the intent of the *Procedural Guidelines for Ecological Risk Assessment at US Army Sites, Volume 1* (Wentsel et al., 1994); the *Framework for Ecological Risk Assessment* (EPA, 1992); the *Risk Assessment Guidance for Superfund, Volume II, Environmental Evaluation Manual* (EPA, 1989b); and the Division of Fish and Wildlife *Impact Analysis for Inactive Hazardous Waste Sites* (NYSDEC, 1994).

Unlike the human health risk assessment, ERAs are complicated by the fact that receptor species are initially unknown and must be identified. Further, data for the site-specific species present are generally not available from toxicological databases Recognizing the complexities associated with evaluating a diverse ecological community, guidance generally provides for a tiered approach to ERAs. The intent of the tiered approach is to collect sufficient information in order to formulate an opinion regarding the risk to the ecological communities present, within an acceptable degree of uncertainty. The tiered approach builds from Tier 1, the least complex, to Tier 3, the most complex, depending on the conditions of the site. The need to collect complex, site-specific toxicity data is reserved for sites where the Tier 1 field reconnaissance suggests that conditions warrant such data collection efforts. The purpose of the higher tiered approaches is to address data gaps and reduce the uncertainty in the risk characterization, thereby lessening the need for conservative assumptions.

Generally, a Tier 1 assessment involves performing a field survey to gain an understanding of the community to be evaluated and collecting quantitative site-specific data to characterize the chemicals of potential concern (COPCs) at the site. The ERA Tier 1 assessment is also supplemented with a literature study. Ecological receptors are determined following the integration of this information. Impacts from exposure are determined using conservative assumptions to assure that a reasonable degree of protection is maintained. Ecological risk is then presented in terms of a hazard quotient (HQ), which is defined as the ratio of the expected exposure point concentration to an appropriate toxicity reference value (TRV). Separate HQs are calculated for each contaminant/receptor pair and are summed, if appropriate, to derive a site-wide hazard index (HI). Uncertainties for the Tier 1 approach are the greatest and arise from extrapolation of the available toxicity data and inference regarding exposure. In general, ratios of exposure point concentration to TRV greater than 1 are considered to indicate a potential risk. Due to the uncertainties associated with using this approach, safety factors are considered in interpreting the findings. HQs between 1 and 10 are interpreted as having some potential for adverse effects; whereas, HQs between 10 and 100 indicate a significant potential for adverse effects. HQs greater than 100 indicate that adverse effects can be expected.

Tier 2 assessments address site-specific issues, limiting reliance on literature-cited values. This may include laboratory studies or limited field studies to determine site-specific TRVs. Tier 3 assessments involve the most complex effort, combining site-specific field observations with laboratory and field data to refine the assumptions of ecological exposure and ecological effects characterization. Tier 3 studies contain population and ecosystem-level evaluations that include long-term characterizations.

The SEAD-16 ERA used a Tier 1 approach and it addresses the three major ERA components: problem formulation, analysis, and risk characterization.

Initial screening of chemicals detected in site samples and selection of COPCs is discussed in Section 6.6.2.1. Characterization of the site and the ecological communities, including the ecological conditions observed at the site, is described in Section 6.6.2.2. Section 6.6.2.3 presents selection of assessment endpoints, receptors, and a conceptual site model. The analysis plan, including measures of effect, measures of exposure, and measures of ecosystem and receptor characteristics is presented in Section 6.6.2.4.

Exposure assessment topics are discussed in Section 6.6.3. Section 6.6.3.1 discusses the chemical distribution of the COPCs at the site. Receptor distribution and its effects on exposure are discussed in Section 6.6.3.2. Daily intakes of COPCs through exposure to environmental media are quantified in Section 6.6.3.3. The assessment of ecological effects that potentially may result from receptor exposure to COPCs at the site is discussed in Section 6.6.3.4, Effects

Assessment. This section includes the evaluation of the potential toxicity of each COPC in each medium and defines toxicity reference values that will be used to calculate the HQ.

Section 6.6.4, Risk Characterization, integrates the results of the preceding elements of the assessment. It estimates risk with respect to the assessment endpoints, based on the predicted exposure to and toxicity of each COPC. The risk characterization also summarizes the ecological risk and interprets its ecological significance, and identifies those chemicals that should be considered chemicals of concern (COCs) for each medium at the site.

6.6.2 Problem Formulation

Problem formulation establishes the goals, breadth, and focus of the ERA through the following:

- Identification of the ecological COPCs
- Characterization of ecological communities
- Selection of assessment endpoints
- Presentation of an ecological conceptual site model
- Selection of an analysis plan (including measures of effects).

6.6.2.1 Identification of Ecological Constituents of Potential Concern

As described in Section 6.2, environmental media were sampled at the Abandoned Deactivation Furnace during the RI to characterize the nature and the extent of impacts in each medium. Following data validation, the data were uploaded into medium-specific databases and each database was then simplified to remove from further consideration those constituents that were either not detected during the investigations or were determined to be similar to background concentrations (for inorganics only). The analytes detected in soil, surface water, sediment, and groundwater are listed in Table 6-3, along with their frequency of detection and maximum detected concentration. The data were evaluated in accordance with EPA data validation guidance contained in *Risk Assessment Guidance for Superfund: Volume I - Human Health Evaluation Manual* (EPA, 1989a). All data qualifiers were considered.

After combining analytical data and eliminating those analytes not detected in any samples in a particular medium, the analytical data were evaluated on the basis of quality with respect to sample quantitation limits, laboratory qualifiers and codes, and blanks. Data were selected for use in the BRA based on EPA guidance (EPA, 1989a) and included data with no qualifiers, data with qualifiers that indicated uncertainties in concentrations but not in chemical identification, and data for chemical concentrations detected at levels significantly elevated above concentrations detected in associated sample blanks. Contaminant data that were rejected for use in the risk assessment were those with an R (unreliable) qualifier.

Following the elimination of unreliable data, concentrations in soil were compared to appropriate background levels, as described in Section 6.2.3 and presented in Table 6-2. Inorganic analytes in soil and groundwater were eliminated from the site risk assessment if the statistical evaluation of significance, using the Wilcoxon Rank Sum (WRS) Test determined that there was no significant difference at the 95th percentile confidence interval, between the site data set and the background database. The background database used for comparison comprises over 60 soil samples and 31 groundwater samples, collected at numerous sites throughout the 10,000-acre SEDA facility, and is representative of background soil and groundwater concentrations. Facility-wide background data were used to identify elevated concentrations of inorganic analytes related to the site. No comparison to background for anthropogenic organic compounds, such as polynuclear aromatic hydrocarbons (PAHs), was performed as the concentrations of these compounds generally are below detectable concentrations in the background locations used to construct the existing database. The existing background soil database has been compiled over the past five years of investigations and the background groundwater database over the past three years of investigations, each from several locations within the SEDA facility boundary. These databases represent soil and groundwater concentrations at locations considered to be pristine. Consequently, no organic compounds were eliminated from further consideration as a result of this comparison.

The draft *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (EPA, 1994b) describes an initial screening step in an ERA. This step consists of preliminary problem formulation, for which the following are determined:

- Environmental setting and constituents at the site
- Fate and transport of constituents
- Ecotoxicity and potential receptors
- Complete exposure pathways.

According to EPA guidance (EPA, 1994b), the next step in the screening process is the evaluation of the ecological effects associated with the chemicals at the site and development of a toxicity profile and screening ecotoxicity value for those chemicals. The toxicity profile, gathered from information in the scientific literature, should describe the toxic mechanisms of action for the exposure route being evaluated and the dose that causes a specified adverse effect. A screening-level ecotoxicity value, or benchmark, should be developed. The highest exposure level at which no adverse effects have been demonstrated is appropriate for the initial screening assessment to ensure that risk is not underestimated. Consistent with the EPA guidance, for each receptor and constituent, the maximum detected concentration is compared to the appropriate screening value, which includes the following:

a. Soil screening using no observed adverse effect levels (NOAELs) for wildlife species (based on dietary exposure)

The maximum concentration of each analyte detected in each soil exposure group (surface and subsurface soil) was incorporated into a dietary intake equation and was then compared to a risk-based dietary benchmark. The screening intake equation, based on *EPA Region IV Guidance for Wildlife Screening Values* (EPA, 1995), conservatively assumes that the entire diet of the receptor consists of soil, all of which contains the maximum detected concentration of the analyte. Receptors are not site-specific, but instead, are the animals used in the analyte-specific toxicity studies, as shown in Table 6-10. However, since a deer mouse was selected as a site-specific receptor for the later phases of the risk assessment, toxicity tests using species most closely related to the deer mouse were sought.

The screening intake equation is:

$$SI = (CS_{max})\,(f)\,(1/w)$$

where:
SI = screening intake in milligrams per kilogram body weight per day (mg/kg/d)
CS_{max} = maximum soil concentration in mg/kg
f = feeding rate of test animal in kg/d dry weight ingested
w = body weight of test animal in kg

TABLE 6-10

TOXICITY DATA FOR ECOLOGICAL SCREENING
SURFACE AND SUBSURFACE SOIL

SEAD-16 Remedial Investigation
Seneca Army Depot

Constituent	Test Organism	Endpoint/Duration/Effect	Source	Effect Dose (mg/kg/d)	Surrogate Chemical UF[1]	Endpoint UF[1]	Study Duration UF[1]	Total UF[1]	Toxicity Screening Benchmark (mg/kg/d)[2]
Volatile Organics									
2-Butanone	rat	NOAEL,gavage, 13-wk, neurological effects	ATSDR 1990c	1.73E+02	1	1	5	5	3.46E+01
Acetone	mouse	NOAEL, water, 13-wk, reproductive effects	ATSDR 1994a	4.86E+03	1	1	5	5	9.72E+02
Benzene	mouse	LOAEL, water, 4-wk, immunologic/neurologic effects	ATSDR 1995a	8.00E+00	1	5	10	50	1.60E-01
Carbon disulfide	rat	NOAEL, gavage (oil), 4-wk, cardiac effects	ATSDR 1994b	2.53E+02	1	1	10	10	2.53E+01
Chloroform	mouse	LOAEL, water, 52-wk, hepatic & renal effects	ATSDR 1995b	8.60E+01	1	5	1	5	1.72E+01
Methylene chloride	mouse	NOAEL, water, 104-wk, hepatic effects	ATSDR 1991c	1.75E+02	1	1	1	1	1.75E+02
1,1,2,2-Tetrachloroethane	mouse	NOAEL, gavage (oil), 78-wk, multiple systems	ATSDR 1994g	1.42E+02	1	1	1	1	1.42E+02
Toluene	mouse	NOAEL, water, 28-day, liver weight	ATSDR 1994h	2.20E+01	1	1	10	10	2.20E+00
Xylene (total)	mouse	NOAEL, gavage (oil), 103-wk, multiple systems	ATSDR 1995f	1.00E+03	1	1	1	1	1.00E+03
Semivolatile Organics									
2,4-Dinitrotoluene	rat	NOAEL, diet, 2-yr, changes in seminiferous tubules	EPA (IRIS) 1996b	3.90E+00	1	1	1	1	3.90E+00
2,6-Dinitrotoluene	rat	Used 2,4-dinitrotoluene as surrogate		3.90E+00	10	1	1	10	3.90E-01
2-Methylnaphthalene	mouse	Used napthalene as surrogate		1.33E+02	10	1	5	50	2.66E+00
2-Methylphenol	mink	NOAEL, diet, 6 months, reproduction	Sample et al 1996	2.19E+02	1	1	5	5	4.38E+01
3,3-Dichlorobenzidene	mouse	LD50, oral, female	EPA (STF) 1996d	3.52E+02	1	15	10	150	2.35E+00
3-Nitroaniline	mouse	LD50, oral (4-nitroaniline)	EPA (STF) 1996d	8.10E+02	10	15	10	1500	5.40E-01
Acenaphthene	mouse	LOAEL, gavage (oil), 13-wk, hepatic effects	ATSDR 1995c	1.75E+02	1	5	5	25	7.00E+00
Acenaphthylene	mouse	Used benzo(a)pyrene as surrogate		1.60E+02	10	5	1	50	3.20E+00
Anthracene	mouse	NOAEL, gavage (oil), 13-wk, repro, hepatic effects	ATSDR 1995c	1.00E+03	1	1	5	5	2.00E+02
Benzo(a)anthracene	mouse	Used benzo(a)pyrene as surrogate		1.60E+02	10	5	1	50	3.20E+00
Benzo(a)pyrene	mouse	LOAEL, gavage, gestation day 7-16, repro effects	ATSDR 1995c	1.60E+02	1	5	1	5	3.20E+01
Benzo(b)fluoranthene	mouse	Used benzo(a)pyrene as surrogate		1.60E+02	10	5	1	50	3.20E+00
Benzo(ghi)perylene	mouse	Used benzo(a)pyrene as surrogate		1.60E+02	10	5	1	50	3.20E+00
Benzo(k)fluoranthene	mouse	Used benzo(a)pyrene as surrogate		1.60E+02	10	5	1	50	3.20E+00
Carbazole	mouse	TDLo, oral, 12-wk	RTECS, 1996	3.34E+03	1	5	5	25	1.33E+02
Chrysene	mouse	Used benzo(a)pyrene as surrogate		1.60E+02	10	5	1	50	3.20E+00
Di-n-butyl phthalate	mouse	NOAEL, diet, 105-day, repro, hepatic, body wt effects	ATSDR 1989	3.90E+02	1	1	5	5	7.80E+01
Dibenz(a,h)anthracene	mouse	Used benzo(a)pyrene as surrogate		1.60E+02	10	5	1	50	3.20E+00
Dibenzofuran		no data							no data
Diethylphthalate	mouse	NOAEL, diet, 105-day, reproduction	Sample et al 1996	4.58E+03	1	1	1	1	4.58E+03
Fluoranthene	mouse	LOAEL, gavage (oil), 13-wk, incr liver weight	ATSDR 1995c	1.25E+02	1	5	5	25	5.00E+00
Flourene	mouse	LOAEL, gavage (oil), 13-wk, incr liver weight	ATSDR 1995c	1.25E+02	1	5	5	25	5.00E+00
Indeno(1,2,3-cd)pyrene	mouse	Used benzo(a)pyrene as surrogate		1.60E+02	10	5	1	50	3.20E+00
n-Nitrosodiphenylamine	mouse	LOAEL, diet, 98-wk, bladder effects	ATSDR 1991d	3.01E+02	1	5	1	5	6.02E+01
Naphthalene	mouse	NOAEL, gavage (oil), 90-day, multiple systems	ATSDR 1995d	1.33E+02	1	1	5	5	2.66E+01
Pentachlorophenol	rat	NOAEL, diet, 62-d prior to mating, 15-d during mating,	Sample et al 1996	2.40E-01	1	1	1	1	2.40E-01

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Phenanthrene	mouse	Used benzo(a)pyrene as surrogate		1.60E+02	10	5	1	50	3.20E+00
Pyrene	mouse	Used benzo(a)pyrene as surrogate		1.60E+02	10	5	1	50	3.20E+00
bis(2-Ethylhexyl)phthalate	rat	LOAEL, diet, 2-year, hepatic cell membrane structure	ATSDR 1993a	1.00E+01	1	5	1	5	2.00E+00
Pesticides/PCBs									
4,4-DDD	mouse	NOAEL, diet, 78-wk, multiple systems	ATSDR 1994d	1.07E+02	1	1	1	1	1.07E+02
4,4-DDE	mouse	NOAEL, diet, 78-week, multiple systems	ATSDR 1994d	3.40E+01	1	1	1	1	3.40E+01
4,4-DDT	mouse	LOAEL, diet, 70-week, decreased survival, tremors	ATSDR 1994d	1.30E+01	1	5	1	5	2.60E+00
Aldrin	rat	NOAEL, diet, 3 generations (>1yr), repro effects	Sample et al 1996	2.00E-01	1	1	1	1	2.00E-01
Arochlor-1254	oldfield	LOAEL, diet, 12 months, repro effects	Sample et al 1996	6.80E-01	1	5	1	5	1.36E-01
Arochlor-1260		Used Arochlor-1254 as surrogate		6.80E-01	10	5	1	50	1.36E-02
Dieldrin	rat	LOAEL, diet, 3 generations (> 1 yr), repro effects	Sample et al 1996	2.00E-01	1	5	1	5	4.00E-02
Endosulfan I	mouse	NOAEL, diet, 78-week, renal effects	ATSDR 1993b	2.50E+00	1	1	1	1	2.50E+00
Endosulfan II	mouse	NOAEL, diet, 78-week, renal effects	ATSDR 1993b	2.50E+00	1	1	1	1	2.50E+00
Endosulfan sulfate	mouse	Used endosulfan as surrogate		2.50E+00	10	1	1	10	2.50E-01
Endrin	mouse	LOAEL, diet, 80-week, multiple systems	ATSDR 1994e	4.20E-01	1	5	1	5	8.40E-02
Endrin aldehyde	rat	LOAEL, diet, 15-day, hepatic effects	ATSDR, 1994e	5.00E-01	1	5	10	50	1.00E-02
Endrin ketone	mouse	Used endrin as surrogate		4.20E-01	10	5	1	50	8.40E-03
Heptachlor	rat	LOAEL, diet, 18-month, reproduction	ATSDR 1993c	6.00E+00	1	5	1	5	1.20E+00
Heptachlor epoxide	rat	Used heptachlor as surrogate	ATSDR 1993c	6.00E+00	10	5	1	50	1.20E-01
Toxaphene	rat	NOAEL, diet, 3 generations, reproduction	Sample et al 1996	8.00E+00	1	1	1	1	8.00E+00
alpha Chlordane	mouse	NOAEL, diet, 24-mo, hepatic effects	ATSDR 1994c	1.00E-01	1	1	1	1	1.00E-01
beta-BHC	rat	NOAEL, diet, 13-week, growth, blood chem, histology	Sample et al 1996	4.00E+00	1	1	5	5	8.00E-01
delta-BHC	rat	NOAEL, diet, 4 generations, repro effects	Sample et al 1996	1.60E+00	1	1	1	1	1.60E+00
gamma-BHC (lindane)	rat	NOAEL, diet, 3 generations (>1 yr), repro effects	Sample et al 1996	8.00E+00	1	1	1	1	8.00E+00
gamma Chlordane	mouse	NOAEL, diet, 6 generations, (>1 yr), repro effects	Sample et al 1996	4.58E+00	1	1	1	1	4.58E+00
Herbicides									
2,4,5-T	rat	LOAEL, diet, 2-yr, increased urinary coproporphyrine	EPA (IRIS) 1996b	1.00E+01	1	5	1	5	2.00E+00
MCPP	rat	NOEL, oral, 90-day, increased kidney weight	RTECS 1996	3.00E+00	1	1	5	5	6.00E-01
Nitroaromatics									
2-amino-4,6-Dinitrotoluene	rat	LD50, oral, acute	RTECS 1996	2.02E+02	1	15	10	150	1.35E+00
Tetryl	rat	Lethal dose, gavage, 18-day	ATSDR 1995e	1.00E+03	1	20	10	200	5.00E+00

TABLE 6-10

TOXICITY DATA FOR ECOLOGICAL SCREENING SURFACE AND SUBSURFACE SOIL

SEAD-16 Remedial Investigation
Seneca Army Depot

Constituent	Test Organism	Endpoint/Duration/Effect	Source	Effect Dose (mg/kg/d)	Surrogate Chemical UF[1]	Endpoint UF[1]	Study Duration UF[1]	Total UF[1]	Toxicity Screening Benchmark (mg/kg/d)[2]
Metals									
Antimony	mouse	NOAEL, water, 542-day, hepatic effects	ATSDR 1990a	3.50E-01	1	1	1	1	3.50E-01
Barium	rat	NOAEL, drinking water, 16-mo	Sample et al 1996	5.06E+00	1	1	1	1	5.06E+00
Copper	mouse	NOAEL, diet, 13-wk, gastrointestinal effects	ATSDR 1990d	7.10E+01	1	1	5	5	1.42E+01
Lead	rat	NOAEL, food, 3 generations, reproduction	Sample et al 1996	8.00E+00	1	1	1	1	8.00E+00
Mercury	mouse	NOAEL, diet, 104-week, kidney effects	ATSDR 1994f	3.00E-02	1	1	1	1	3.00E-02
Selenium	mouse	LOAEL, water, 3 generations, reproductive effects	Sample et al 1996	7.50E-01	1	5	1	5	1.50E-01
Thallium	rat	NOAEL, gavage, 90-day, multiple systems	ATSDR 1990f	2.00E-01	1	1	5	5	4.00E-02
Zinc	rat	NOAEL, diet, gestation day 1-16, development effect	Sample et al 1996	1.60E+02	1	1	1	1	1.60E+02

[1] UF = uncertainty factor. Uncertainty factors are based on a modified EPA Region VIII method as discussed in Section 6.6.

[2] The toxicity screening benchmark was derived by dividing the effect dose by the total uncertainty factor.

Maximum concentrations of the surface soil analytes (0 to 0.5 ft) are shown in Table 6-11, and for the subsurface soil (0 to 4 ft) in Table 6-12. Toxicity benchmarks reflecting a dietary NOAEL were sought for benchmarks in the soil screening. Where NOAEL tests could not be found, other tests with endpoints of lowest observed adverse effect level (LOAEL) or lethal dose for 50 percent of the test animals (LD_{50}) were used, with appropriate uncertainty factors to equate the test to a NOAEL. Uncertainty factors were modified from those published by EPA Region VIII (EPA, 1994a), as shown in Table 6-10.

Toxicity tests and test endpoints used to develop the preliminary screening values for soil contaminants are shown in Table 6-10. Feeding rates and body weights of the animals used in the toxicity tests, as well as results of the toxicity screening, are shown in Tables 6-11 and 6-12.

b. Surface water screening using toxicity-based benchmarks

For surface water screening, the maximum concentration of each detected analyte was compared to NYSDEC Ambient Water Quality Standards and Guidance Values (NYSDEC, 1993a). For chemicals with no NYSDEC screening value, screening values developed by Headquarters EPA (EPA, 1996c) were used. The values, termed Ecotox Thresholds, were developed for screening Superfund-type hazardous waste sites. For chemicals with neither a NYSDEC nor Ecotox Threshold screening value, surface water screening benchmarks developed by EPA Region IV for hazardous waste sites (EPA, 1995) were used. Screening for chemicals detected in surface water is shown in Table 6-13.

c. Sediment screening using toxicity-based benchmarks.

For sediment screening, the maximum concentration of each detected analyte was compared to NYSDEC benchmarks presented in *Technical Guidance for Screening Contaminated Sediments* (NYSDEC, 1993b). For chemicals with no NYSDEC screening value, Ecotox Threshold screening values developed by Headquarters EPA (EPA, 1996c) were used. For chemicals with neither a NYSDEC nor Ecotox Threshold screening value, sediment screening benchmarks developed by EPA Region IV for hazardous

TABLE 6-11

SOIL SCREENING AGAINST ECOLOGICAL TOXICITY SCREENING BENCHMARKS SURFACE SOIL

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Constituent	Maximum Detected Conc. (mg/kg)	Test Organism	Feeding Rate [1] (kg/d)	Body Weight [1] (kg)	Soil Screening Intake [2] (mg/kg/d)	Toxicity Screening Benchmark[3] (mg/kg/d)	Intake Exceeds Toxicity Screening Benchmark[4] (Y/N)
Volatile Organics							
Acetone	1.70E-02	mouse	3.31E-03	2.50E-02	2.25E-03	9.72E+02	N
Benzene	5.00E-03	mouse	3.31E-03	2.50E-02	6.62E-04	1.60E-01	N
Carbon disulfide	2.00E-03	rat	2.55E-02	3.00E-01	1.70E-04	2.53E+01	N
Chloroform	2.00E-03	mouse	3.31E-03	2.50E-02	2.65E-04	1.72E+01	N
Methylene chloride	3.00E-03	mouse	3.31E-03	2.50E-02	3.97E-04	1.75E+02	N
1,1,2,2-Tetrachloroethane	1.00E+01	mouse	3.31E-03	2.50E-02	1.32E+00	1.42E+02	N
Toluene	1.40E-02	mouse	3.31E-03	2.50E-02	1.85E-03	2.20E+00	N
Xylene (total)	3.00E-03	mouse	3.31E-03	2.50E-02	3.97E-04	1.00E+03	N
Semivolatile Organics							
2,4-Dinitrotoluene	8.50E+01	rat	2.55E-02	3.00E-01	7.23E+00	3.90E+00	Y
2,6-Dinitrotoluene	8.00E+00	rat	2.55E-02	3.00E-01	6.80E-01	3.90E-01	Y
2-Methylnaphthalene	1.90E+01	mouse	3.31E-03	2.50E-02	2.52E+00	2.66E+00	N
2-Methylphenol	1.20E-01	mink	1.37E-01	1.00E+00	1.64E-02	4.38E+01	N
3,3-Dichlorobenzidene	8.50E-01	mouse	3.31E-03	2.50E-02	1.13E-01	2.35E+00	N
3-Nitroaniline	2.10E+00	mouse	3.31E-03	2.50E-02	2.78E-01	5.40E-01	N
Acenaphthene	7.20E+01	mouse	3.31E-03	2.50E-02	9.53E+00	7.00E+00	Y
Acenaphthylene	3.10E-01	mouse	3.31E-03	2.50E-02	4.10E-02	3.20E+00	N
Anthracene	1.20E+02	mouse	3.31E-03	2.50E-02	1.59E+01	2.00E+02	N
Benzo(a)anthracene	2.20E+02	mouse	3.31E-03	2.50E-02	2.91E+01	3.20E+00	Y
Benzo(a)pyrene	2.00E+02	mouse	3.31E-03	2.50E-02	2.65E+01	3.20E+01	N
Benzo(b)fluoranthene	2.00E+02	mouse	3.31E-03	2.50E-02	2.65E+01	3.20E+00	Y
Benzo(ghi)perylene	1.00E+02	mouse	3.31E-03	2.50E-02	1.32E+01	3.20E+00	Y
Benzo(k)fluoranthene	1.70E+02	mouse	3.31E-03	2.50E-02	2.25E+01	3.20E+00	Y
Carbazole	8.90E+01	mouse	3.31E-03	2.50E-02	1.18E+01	1.33E+02	N
Chrysene	2.20E+02	mouse	3.31E-03	2.50E-02	2.91E+01	3.20E+00	Y
Di-n-butyl phthalate	1.60E+01	mouse	3.31E-03	2.50E-02	2.12E+00	7.80E+01	N
Dibenz(a,h)anthracene	4.90E+01	mouse	3.31E-03	2.50E-02	6.49E+00	3.20E+00	Y
Dibenzofuran	5.00E+01					no data	Y
Diethylphthalate	1.90E-02	mouse	3.31E-03	2.50E-02	2.52E-03	4.58E+03	N
Fluoranthene	5.30E+02	mouse	3.31E-03	2.50E-02	7.02E+01	5.00E+00	Y
Flourene	7.80E+01	mouse	3.31E-03	2.50E-02	1.03E+01	5.00E+00	Y

TABLE 6-11

SOIL SCREENING AGAINST ECOLOGICAL TOXICITY SCREENING BENCHMARKS
SURFACE SOIL

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Constituent	Maximum Detected Conc. (mg/kg)	Test Organism	Feeding Rate [1] (kg/d)	Body Weight [1] (kg)	Soil Screening Intake [2] (mg/kg/d)	Toxicity Screening Benchmark[3] (mg/kg/d)	Intake Exceeds Toxicity Screening Benchmark[4] (Y/N)
Indeno(1,2,3-cd)pyrene	1.00E+02	mouse	3.31E-03	2.50E-02	1.32E+01	3.20E+00	Y
n-Nitrosodiphenylamine	2.50E+01	mouse	3.31E-03	2.50E-02	3.31E+00	6.02E+01	N
Naphthalene	6.60E+01	mouse	3.31E-03	2.50E-02	8.74E+00	2.66E+01	N
Pentachlorophenol	1.20E+00	rat	2.55E-02	3.00E-01	1.02E-01	2.40E-01	N
Phenanthrene	4.90E+02	mouse	3.31E-03	2.50E-02	6.49E+01	3.20E+00	Y
Pyrene	3.60E+02	mouse	3.31E-03	2.50E-02	4.77E+01	3.20E+00	Y
bis(2-Ethylhexyl)phthalate	2.10E+00	rat	2.55E-02	3.00E-01	1.79E-01	2.00E+00	N
Pesticides/PCBs							
p,p'-DDD	2.30E-02	mouse	3.31E-03	2.50E-02	3.05E-03	1.07E+02	N
p,p'-DDE	1.40E+00	mouse	3.31E-03	2.50E-02	1.85E-01	3.40E+01	N
p,p'-DDT	3.40E-01	mouse	3.31E-03	2.50E-02	4.50E-02	2.60E+00	N
Aldrin	5.00E-03	rat	2.55E-02	3.00E-01	4.25E-04	2.00E-01	N
Arochlor-1254	1.10E+00	oldfield mouse	1.74E-03	1.20E-02	1.60E-01	1.36E-01	Y
Arochlor-1260	3.40E-01	oldfield mouse	1.74E-03	1.20E-02	4.93E-02	1.36E-02	Y
Dieldrin	2.60E-02	rat	2.55E-02	3.00E-01	2.21E-03	4.00E-02	N
Endosulfan I	4.30E-01	mouse	3.31E-03	2.50E-02	5.69E-02	2.50E+00	N
Endosulfan II	5.00E-03	mouse	3.31E-03	2.50E-02	6.62E-04	2.50E+00	N
Endosulfan sulfate	2.00E-02	mouse	3.31E-03	2.50E-02	2.65E-03	2.50E-01	N
Endrin	4.30E-02	mouse	3.31E-03	2.50E-02	5.69E-03	8.40E-02	N
Endrin aldehyde	1.40E-02	rat	2.55E-02	3.00E-01	1.19E-03	1.00E-02	N
Endrin ketone	7.10E-02	mouse	3.31E-03	2.50E-02	9.40E-03	8.40E-03	Y
Heptachlor	1.80E-03	rat	2.55E-02	3.00E-01	1.53E-04	1.20E+00	N
Heptachlor epoxide	6.70E-03	rat	2.55E-02	3.00E-01	5.70E-04	1.20E-01	N
Toxaphene	1.80E-01	rat	2.55E-02	3.00E-01	1.53E-02	8.00E+00	N
alpha Chlordane	1.70E-01	mouse	3.31E-03	2.50E-02	2.25E-02	1.00E-01	N
beta-BHC	2.00E-02	rat	2.55E-02	3.00E-01	1.70E-03	8.00E-01	N
delta-BHC	2.20E-03	rat	2.55E-02	3.00E-01	1.87E-04	1.60E+00	N
gamma-BHC (lindane)	2.30E-03	rat	2.55E-02	3.00E-01	1.96E-04	8.00E+00	N
gamma-Chlordane	2.00E-01	mouse	3.31E-03	2.50E-02	2.65E-02	4.58E+00	N

TABLE 6-11

SOIL SCREENING AGAINST ECOLOGICAL TOXICITY SCREENING BENCHMARKS SURFACE SOIL

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Constituent	Maximum Detected Conc. (mg/kg)	Test Organism	Feeding Rate [1] (kg/d)	Body Weight [1] (kg)	Soil Screening Intake [2] (mg/kg/d)	Toxicity Screening Benchmark[3] (mg/kg/d)	Intake Exceeds Toxicity Screening Benchmark[4] (Y/N)
Herbicides							
2,4,5-T	8.30E-03	rat	2.55E-02	3.00E-01	7.06E-04	2.00E+00	N
MCPP	1.60E+01	rat	2.55E-02	3.00E-01	1.36E+00	6.00E-01	Y
Nitroaromatics							
2-amino-4,6-Dinitrotoluene	4.30E-01	mouse	3.31E-03	2.50E-02	5.69E-02	1.35E+00	N
Tetryl	2.20E-01	rat	2.55E-02	3.00E-01	1.87E-02	5.00E+00	N
Metals							
Antimony	1.93E+03	mouse	3.31E-03	2.50E-02	2.56E+02	3.50E-01	Y
Barium	9.34E+03	rat	2.55E-02	3.00E-01	7.94E+02	5.06E+00	Y
Copper	3.79E+04	mouse	3.31E-03	2.50E-02	5.02E+03	1.42E+01	Y
Lead	1.40E+05	rat	2.55E-02	3.00E-01	1.19E+04	8.00E+00	Y
Mercury	1.14E+01	mouse	3.31E-03	2.50E-02	1.51E+00	3.00E-02	Y
Selenium	1.60E+00	mouse	3.31E-03	2.50E-02	2.12E-01	1.50E-01	Y
Thallium	1.66E+01	rat	2.55E-02	3.00E-01	1.41E+00	4.00E-02	Y
Zinc	1.46E+04	rat	2.55E-02	3.00E-01	1.24E+03	1.60E+02	Y

[1] Body weight and feeding rate are based on the species used in the toxicity study from which the toxicity screening benchmark for this chemical was derived (see Table 6-10).

[2] Soil screening intake = (maximum concentration * feeding rate) / body weight.

[3] Toxicity screening benchmarks are calculated from toxicity values with appropriate EPA Region VIII uncertainty factors to derive a NOAEL equivalent value (see Table 6-10).

[4] Y = Soil screening intake exceeds toxicity screening benchmark, or no screening benchmark is available.
N = Soil screening intake is less than toxicity screening benchmark.

TABLE 6-12

SOIL SCREENING AGAINST ECOLOGICAL TOXICITY SCREENING BENCHMARKS
SUBSURFACE SOIL

SEAD-16 Remedial Investigation
Seneca Army Depot

Constituent	Maximum Detected Conc. (mg/kg)	Test Organism	Feeding Rate [1] (kg/d)	Body Weight [1] (kg)	Soil Screening Intake [2] (mg/kg/d)	Toxicity Screening Benchmark[3] (mg/kg/d)	Intake Exceeds Toxicity Screening Benchmark[4] (Y/N)
Volatile Organics							
2-Butanone	5.00E-03	rat	2.55E-02	3.00E-01	4.25E-04	3.46E+01	N
Acetone	4.60E-02	mouse	3.31E-03	2.50E-02	6.09E-03	9.72E+02	N
Benzene	5.00E-03	mouse	3.31E-03	2.50E-02	6.62E-04	1.60E-01	N
Carbon disulfide	2.00E-03	rat	2.55E-02	3.00E-01	1.70E-04	2.53E+01	N
Chloroform	2.00E-03	mouse	3.31E-03	2.50E-02	2.65E-04	1.72E+01	N
Methylene chloride	3.00E-03	mouse	3.31E-03	2.50E-02	3.97E-04	1.75E+02	N
1,1,2,2-Tetrachloroethane	1.00E+01	mouse	3.31E-03	2.50E-02	1.32E+00	1.42E+02	N
Toluene	1.40E-02	mouse	3.31E-03	2.50E-02	1.85E-03	2.20E+00	N
Xylene (total)	3.00E-03	mouse	3.31E-03	2.50E-02	3.97E-04	1.00E+03	N
Semivolatile Organics							
2,4-Dinitrotoluene	8.50E+01	rat	2.55E-02	3.00E-01	7.23E+00	3.90E+00	Y
2,6-Dinitrotoluene	8.00E+00	rat	2.55E-02	3.00E-01	6.80E-01	3.90E-01	Y
2-Methylnaphthalene	1.90E+01	mouse	3.31E-03	2.50E-02	2.52E+00	2.66E+00	N
2-Methylphenol	1.20E-01	mink	2.55E-02	3.00E-01	1.02E-02	4.38E+01	N
3,3-Dichlorobenzidene	8.50E-01	mouse	3.31E-03	2.50E-02	1.13E-01	2.35E+00	N
3-Nitroaniline	2.10E+00	mouse	3.31E-03	2.50E-02	2.78E-01	5.40E-01	N
Acenaphthene	7.20E+01	mouse	3.31E-03	2.50E-02	9.53E+00	7.00E+00	Y
Acenaphthylene	3.10E-01	mouse	3.31E-03	2.50E-02	4.10E-02	3.20E+00	N
Anthracene	1.20E+02	mouse	3.31E-03	2.50E-02	1.59E+01	2.00E+02	N
Benzo(a)anthracene	2.20E+02	mouse	3.31E-03	2.50E-02	2.91E+01	3.20E+00	Y
Benzo(a)pyrene	2.00E+02	mouse	3.31E-03	2.50E-02	2.65E+01	3.20E+01	N
Benzo(b)fluoranthene	2.00E+02	mouse	3.31E-03	2.50E-02	2.65E+01	3.20E+00	Y
Benzo(ghi)perylene	1.00E+02	mouse	3.31E-03	2.50E-02	1.32E+01	3.20E+00	Y
Benzo(k)fluoranthene	1.70E+02	mouse	3.31E-03	2.50E-02	2.25E+01	3.20E+00	Y
Carbazole	8.90E+01	mouse	3.31E-03	2.50E-02	1.18E+01	1.33E+02	N
Chrysene	2.20E+02	mouse	3.31E-03	2.50E-02	2.91E+01	3.20E+00	Y
Di-n-butyl phthalate	1.60E+01	mouse	3.31E-03	2.50E-02	2.12E+00	7.80E+01	N
Dibenz(a,h)anthracene	4.90E+01	mouse	3.31E-03	2.50E-02	6.49E+00	3.20E+00	Y
Dibenzofuran	5.00E+01					no data	Y
Diethylphthalate	1.90E-02	mouse	3.31E-03	2.50E-02	2.52E-03	4.58E+03	N
Fluoranthene	5.30E+02	mouse	3.31E-03	2.50E-02	7.02E+01	5.00E+00	Y

TABLE 6-12

SOIL SCREENING AGAINST ECOLOGICAL TOXICITY SCREENING BENCHMARKS
SUBSURFACE SOIL

SEAD-16 Remedial Investigation
Seneca Army Depot

Constituent	Maximum Detected Conc. (mg/kg)	Test Organism	Feeding Rate[1] (kg/d)	Body Weight[1] (kg)	Soil Screening Intake[2] (mg/kg/d)	Toxicity Screening Benchmark[3] (mg/kg/d)	Intake Exceeds Toxicity Screening Benchmark[4] (Y/N)
Flourene	7.80E+01	mouse	3.31E-03	2.50E-02	1.03E+01	5.00E+00	Y
Indeno(1,2,3-cd)pyrene	1.00E+02	mouse	3.31E-03	2.50E-02	1.32E+01	3.20E+00	Y
n-Nitrosodiphenylamine	2.50E+01	mouse	3.31E-03	2.50E-02	3.31E+00	6.02E+01	N
Naphthalene	6.60E+01	mouse	3.31E-03	2.50E-02	8.74E+00	2.66E+01	N
Pentachlorophenol	1.20E+00	rat	2.55E-02	3.00E-01	1.02E-01	2.40E-01	N
Phenanthrene	4.90E+02	mouse	3.31E-03	2.50E-02	6.49E+01	3.20E+00	Y
Pyrene	3.60E+02	mouse	3.31E-03	2.50E-02	4.77E+01	3.20E+00	Y
bis(2-Ethylhexyl)phthalate	2.10E+00	rat	2.55E-02	3.00E-01	1.79E-01	2.00E+00	N
Pesticides/PCBs							
4,4'-DDD	2.30E-02	mouse	3.31E-03	2.50E-02	3.05E-03	1.07E+02	N
4,4'-DDE	1.40E+00	mouse	3.31E-03	2.50E-02	1.85E-01	3.40E+01	N
4,4'-DDT	3.40E-01	mouse	3.31E-03	2.50E-02	4.50E-02	2.60E+00	N
Aldrin	5.00E-03	rat	2.55E-02	3.00E-01	4.25E-04	2.00E-01	N
Arochlor-1254	1.10E+00	oldfield mouse	1.74E-03	1.20E-02	1.60E-01	1.36E-01	Y
Arochlor-1260	3.40E-01	oldfield mouse	1.74E-03	1.20E-02	4.93E-02	1.36E-02	Y
Dieldrin	2.60E-02	rat	2.55E-02	3.00E-01	2.21E-03	4.00E-02	N
Endosulfan I	4.30E-01	mouse	3.31E-03	2.50E-02	5.69E-02	2.50E+00	N
Endosulfan II	5.00E-03	mouse	3.31E-03	2.50E-02	6.62E-04	2.50E+00	N
Endosulfan sulfate	2.00E-02	mouse	3.31E-03	2.50E-02	2.65E-03	2.50E-01	N
Endrin	4.30E-02	mouse	3.31E-03	2.50E-02	5.69E-03	8.40E-02	N
Endrin aldehyde	1.40E-02	rat	2.55E-02	3.00E-01	1.19E-03	1.00E-02	N
Endrin ketone	7.10E-02	mouse	3.31E-03	2.50E-02	9.40E-03	8.40E-03	Y
Heptachlor	1.80E-03	rat	2.55E-02	3.00E-01	1.53E-04	1.20E+00	N
Heptachlor epoxide	6.70E-03	rat	2.55E-02	3.00E-01	5.70E-04	1.20E-01	N
Toxaphene	1.80E-01	rat	2.55E-02	3.00E-01	1.53E-02	8.00E+00	N
alpha Chlordane	1.70E-01	mouse	3.31E-03	2.50E-02	2.25E-02	1.00E-01	N
beta-BHC	2.00E-02	rat	2.55E-02	3.00E-01	1.70E-03	8.00E-01	N
delta-BHC	2.20E-03	rat	2.55E-02	3.00E-01	1.87E-04	1.60E+00	N
gamma-BHC (lindane)	2.30E-03	rat	2.55E-02	3.00E-01	1.96E-04	8.00E+00	N
gamma-Chlordane	2.00E-01	mouse	3.31E-03	2.50E-02	2.65E-02	4.58E+00	N

TABLE 6-12

SOIL SCREENING AGAINST ECOLOGICAL TOXICITY SCREENING BENCHMARKS
SUBSURFACE SOIL

SEAD-16 Remedial Investigation
Seneca Army Depot

Constituent	Maximum Detected Conc. (mg/kg)	Test Organism	Feeding Rate [1] (kg/d)	Body Weight [1] (kg)	Soil Screening Intake [2] (mg/kg/d)	Toxicity Screening Benchmark[3] (mg/kg/d)	Intake Exceeds Toxicity Screening Benchmark[4] (Y/N)
Herbicides							
2,4,5-T	8.30E-03	rat	2.55E-02	3.00E-01	7.06E-04	2.00E+00	N
MCPP	1.60E+01	rat	2.55E-02	3.00E-01	1.36E+00	6.00E-01	Y
Nitroaromatics							
2-amino-4,6-Dinitrotoluene	4.30E-01	mouse	3.31E-03	2.50E-02	5.69E-02	1.35E+00	N
Tetryl	2.20E-01	rat	2.55E-02	3.00E-01	1.87E-02	5.00E+00	N
Metals							
Antimony	1.93E+03	mouse	3.31E-03	2.50E-02	2.56E+02	3.50E-01	Y
Barium	9.34E+03	rat	2.55E-02	3.00E-01	7.94E+02	5.06E+00	Y
Copper	3.79E+04	mouse	3.31E-03	2.50E-02	5.02E+03	1.42E+01	Y
Lead	1.40E+05	rat	2.55E-02	3.00E-01	1.19E+04	8.00E+00	Y
Mercury	1.14E+01	mouse	3.31E-03	2.50E-02	1.51E+00	3.00E-02	Y
Selenium	1.60E+00	mouse	3.31E-03	2.50E-02	2.12E-01	1.50E-01	Y
Thallium	1.66E+01	rat	2.55E-02	3.00E-01	1.41E+00	4.00E-02	Y
Zinc	1.46E+04	rat	2.55E-02	3.00E-01	1.24E+03	1.60E+02	Y

[1] Body weight and feeding rate are based on the species used in the toxicity study from which the toxicity screening benchmark for this chemical was derived (see Table 6-10).

[2] Soil screening intake = (maximum concentration * feeding rate) / body weight.

[3] Toxicity screening benchmarks are calculated from toxicity values with appropriate EPA Region VIII uncertainty factors to derive a NOAEL equivalent value (see Table 6-10).

[4] Y = Soil screening intake exceeds toxicity screening benchmark, or no screening benchmark is available.
N = Soil screening intake is less than toxicity screening benchmark.

TABLE 6-13

SCREENING AGAINST ECOLOGICAL TOXICITY SCREENING BENCHMARKS
SURFACE WATER

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Constituent	Units	Maximum Detected Concentration	Freshwater Screening Value	Source	Maximum Exceeds Screening Value (Y/N)[1]
Semivolatile Organics					
di-n-Butylphthalate	UG/L	5.00E+03	3.30E+01	(3)	Y
Pentachlorophenol	UG/L	4.00E+03	4.00E-01	(2)	Y
bis(2-Ethylhexyl)phthalate	UG/L	3.00E+03	6.00E-01	(2)	Y
Metals					
Aluminum	UG/L	2.61E+05	1.00E+02	(2)	Y
Antimony	UG/L	1.24E+05	1.60E+02	(4)	Y
Arsenic	UG/L	5.70E+03	1.90E+02	(2)	Y
Barium	UG/L	3.48E+05	3.90E+00	(3)	Y
Cadmium	UG/L	2.00E+03	1.90E+00	(2)	Y
Chromium	UG/L	3.00E+03	3.50E+02	(2)	Y
Copper	UG/L	4.10E+03	2.00E+01	(2)	Y
Cobalt	UG/L	4.24E+05	5.00E+00	(2)	Y
Iron	UG/L	3.65E+06	3.00E+02	(2)	Y
Lead	UG/L	8.13E+05	7.20E+00	(2)	Y
Manganese	UG/L	2.52E+05	8.00E+01	(3)	Y
Mercury	UG/L	9.00E+02	3.00E-03	(3)	Y
Nickel	UG/L	5.50E+03	1.54E+02	(2)	Y
Selenium	UG/L	4.30E+03	1.00E+00	(2)	Y
Silver	UG/L	5.20E+03	1.00E-01	(2)	Y
Vanadium	UG/L	4.90E+03	1.40E+01	(2)	Y
Zinc	UG/L	3.80E+05	1.40E+02	(2)	Y

[1] Y = Maximum sediment concentration exceeds screening benchmark, or no benchmark is available.
N = Maximum sediment concentration is less than screening benchmark.

(2) NYS Ambient Water Quality Standard for Class C waters.

(3) EPA Ecotox Thresholds (EPA, 1996c).

(4) EPA Region IV Freshwater Surface Water Screening Values for Hazardous Waste Sites (EPA, 1995).

For hardness dependent metals (cadmium, chromium, copper, lead, nickel, and zinc) the Class C standard was calculated using an average value of 188.18 mg/L $CaCO_3$.

waste sites (EPA, 1995) were used. Screening for chemicals detected in sediment is shown in Table 6-14.

d. Previously eliminated constituents, media, or exposure groups were evaluated to determine whether they should be re-included due to historical information or considerations such as mobility, bioaccumulation, persistence, and toxicity. No eliminated constituents, media, or exposure groups were re-included.

e. For each medium and/or exposure group, it was determined whether there are any COPCs remaining. If no COPCs remained, the medium and/or exposure group was dropped from further consideration in the ERA.

f. The constituents and exposure routes that were retained after the application of this process were then selected for use as the starting point of the ecological risk analysis. These COPCs, with the maximum and RME concentration of each, are shown in Table 6-15.

While the maximum concentration of a chemical in each medium is appropriate for a conservative screening step, the maximum concentration is an overly conservative representation of an exposure point concentration for the remainder of the ecological risk analysis. An exposure point concentration is the concentration of a COPC in an environmental medium at the location where a receptor contacts the medium. Exposure point concentrations were calculated based on the reasonable maximum exposure (RME) concentration, a conservative concentration that is still within the range of possible exposures, for each complete pathway. Sampling data collected during characterization investigations at the site were used to calculate the exposure point concentrations of COPCs identified in surface soil, subsurface soil, surface water, and sediment. Groundwater was not considered, as there is no complete exposure pathway for receptors to groundwater.

Surface soil sampling data were used to estimate exposure point concentrations of COPCs at SEAD-16 for current land use conditions. Data included surface soil samples from a depth of 0 to 0.5 ft. Risk from soil exposure under future land use conditions was estimated based on exposure point concentrations in soil from a depth of 0 to 4 ft, to allow for the possibility of future excavation of deeper soils to the surface as a result of human activities such as construction or farming. Concentrations of COPCs measured in surface water in the drainage

TABLE 6-14

SCREENING AGAINST ECOLOGICAL TOXICITY SCREENING BENCHMARKS SEDIMENT

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Constituent	Units	Maximum Detected Concentration	Sediment Screening Value	Source	Maximum Exceeds Screening Value (Y/N)[1]
Volatile Organics					
2-Butanone	mg/kg	1.20E-02	none available		Y
Acetone	mg/kg	3.60E-02	none available		Y
Semivolatile Organics					
2,4-Dinitrotoluene	mg/kg	5.40E+00	none available		Y
2-Methylnaphthalene	mg/kg	5.50E-02	3.30E-01	(5)	N
Acenaphthene	mg/kg	3.20E-02	5.10E+00	(2)	N
Acenaphthylene	mg/kg	5.40E-02	3.30E-01	(5)	N
Anthracene	mg/kg	1.00E-01	3.30E-01	(5)	N
Benzo(a)anthracene	mg/kg	5.70E-01	3.30E-01	(5)	Y
Benzo(a)pyrene	mg/kg	6.00E-01	1.57E+00	(3)	N
Benzo(b)fluoranthene	mg/kg	1.20E+00	3.30E-01	(5)	Y
Benzo(g,h,i)perylene	mg/kg	5.30E-01	3.30E-01	(5)	Y
Benzo(k)fluoranthene	mg/kg	7.80E-01	3.30E-01	(5)	Y
Carbazole	mg/kg	1.10E-01	none available		Y
Chrysene	mg/kg	1.20E+00	3.30E-01	(5)	Y
Di-n-butylphthalate	mg/kg	2.50E-01	4.00E+01	(3)	N
Dibenz(a,h)anthracene	mg/kg	1.70E-01	3.30E-01	(5)	N
Fluoranthene	mg/kg	1.60E+00	3.71E+00	(3)	N
Indeno(1,2,3-cd)pyrene	mg/kg	5.00E-01	3.30E-01	(5)	Y
n-Nitrosodiphenylamine	mg/kg	6.00E-01	none available		Y
Phenanthrene	mg/kg	4.20E-01	4.37E+00	(2)	N
Pyrene	mg/kg	1.40E+00	2.40E+00	(3)	N
bis(2-Ethylhexyl)phthalate	mg/kg	2.70E-01	7.26E+00	(2)	N
Pesticides/PCBs					
4,4'-DDD	mg/kg	7.30E-01	3.64E-02	(2)	Y
4,4'-DDE	mg/kg	5.70E-01	3.64E-02	(2)	Y
4,4'-DDT	mg/kg	4.20E-01	3.64E-02	(2)	Y
Aroclor-1254	mg/kg	6.70E-01	7.03E-01	(2)	N
Aroclor-1260	mg/kg	1.30E-01	7.03E-01	(2)	N
Endosulfan I	mg/kg	2.60E-02	1.09E-03	(2)	Y
Endosulfan II	mg/kg	6.80E-03	1.09E-03	(2)	Y
Endosulfan sulfate	mg/kg	1.80E-02	1.09E-03	(2)	Y
Endrin aldehyde	mg/kg	3.20E-03	1.46E-01	(2)	N
Heptachlor epoxide	mg/kg	2.80E-03	3.64E-03	(2)	N
alpha-Chlordane	mg/kg	1.21E-02	1.09E-03	(2)	Y
gamma-Chlordane	mg/kg	3.80E-03	1.09E-03	(2)	Y

TABLE 6-14

SCREENING AGAINST ECOLOGICAL TOXICITY SCREENING BENCHMARKS
SEDIMENT

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Constituent	Units	Maximum Detected Concentration	Sediment Screening Value	Source	Maximum Exceeds Screening Value (Y/N)[1]
Metals					
Aluminum	mg/kg	2.29E+04	none avail		Y
Antimony	mg/kg	5.03E+01	2.00E+00	(4)	Y
Arsenic	mg/kg	9.60E+00	6.00E+00	(4)	Y
Barium	mg/kg	3.98E+03	none avail		Y
Beryllium	mg/kg	9.30E-01	none avail		Y
Cadmium	mg/kg	7.60E+00	6.00E-01	(4)	Y
Chromium	mg/kg	4.35E+01	2.60E+01	(4)	Y
Cobalt	mg/kg	1.56E+01	none avail		Y
Copper	mg/kg	1.75E+04	1.60E+01	(4)	Y
Iron	mg/kg	4.64E+04	2.00E+04	(4)	Y
Lead	mg/kg	4.48E+03	3.10E+01	(4)	Y
Manganese	mg/kg	4.47E+02	4.60E+02	(4)	N
Mercury	mg/kg	2.50E+00	1.50E-01	(4)	Y
Nickel	mg/kg	5.09E+01	1.60E+01	(4)	Y
Selenium	mg/kg	4.90E+00	none avail		Y
Silver	mg/kg	3.50E-01	1.00E+00	(4)	N
Thallium	mg/kg	1.60E+00	none avail		Y
Vanadium	mg/kg	3.98E+01	none avail		Y
Zinc	mg/kg	9.52E+02	1.20E+02	(4)	Y

[1] Y = Maximum sediment concentration exceeds screening benchmark, or no benchmark is available.
N = Maximum sediment concentration is less than screening benchmark.

(2) NYSDEC Equilibrium Partitioning method based on % organic carbon in sample with maximum detected analyte concentration.

(3) EPA Ecotox Thresholds (EPA, 1996).

(4) Lowest Effect Level is the lower of either Persaud et. al (1992) or Long and Morgan (1990).

(5) EPA Region IV Sediment Screening Values for Hazardous Waste Sites (EPA, 1995).

TABLE 6-15

ECOLOGICAL COPCs

SEAD-16 Remedial Investigation
Seneca Army Depot

COPC	Surface Soil		Subsurface Soil		Surface Water		Sediment	
	Max Conc (mg/kg)	RME Conc (mg/kg)	Max Conc (mg/kg)	RME Conc (mg/kg)	Max Conc (ug/L)	RME Conc (ug/L)	Max Conc (mg/kg)	RME Conc (mg/kg)
Volatile Organics								
2-Butanone	(a)	(a)	(a)	(a)	(a)	(a)	1.20E-02	1.01E-02
Acetone	(a)	(a)	(a)	(a)	(a)	(a)	3.60E-02	2.38E-02
Semivolatile Organics								
2,4-Dinitrotoluene	8.50E+01	4.55E+00	8.50E+01	3.80E+00	(a)	(a)	5.40E+00	3.04E+00
2,6-Dinitrotoluene	8.00E+00	1.19E+00	8.00E+00	4.25E-03	(a)	(a)	(a)	(a)
Acenaphthene	7.20E+01	1.52E+00	7.20E+01	1.33E+00	(a)	(a)	(a)	(a)
Benzo(a)anthracene	2.20E+02	2.70E+00	2.20E+02	2.46E+00	(a)	(a)	5.70E-01	3.39E-01
Benzo(a)pyrene	(a)	(a)	(a)	(a)	(a)	(a)	6.00E-01	3.81E-01
Benzo(b)fluoranthene	2.00E+02	3.61E+00	2.00E+02	3.38E+00	(a)	(a)	1.20E+00	7.43E-01
Benzo(ghi)perylene	1.00E+02	2.29E+00	1.00E+02	2.70E+00	(a)	(a)	5.30E-01	3.37E-01
Benzo(k)fluoranthene	1.70E+02	2.31E+00	1.70E+02	2.24E+00	(a)	(a)	7.80E-01	4.43E-01
Carbazole	(a)	(a)	(a)	(a)	(a)	(a)	1.10E-01	1.10E-01
Chrysene	2.20E+02	2.97E+00	2.20E+02	2.77E+00	(a)	(a)	1.20E+00	1.16E+00
Dibenzofuran	5.00E+01	1.36E+00	5.00E+01	1.17E+00	(a)	(a)	(a)	(a)
Dibenz(a,h)anthracene	4.90E+01	1.52E+00	4.90E+01	1.49E+00	(a)	(a)	(a)	(a)
Fluoranthene	5.30E+02	3.84E+00	5.30E+02	3.68E+00	(a)	(a)	(a)	(a)
Flourene	7.80E+01	1.39E+00	7.80E+01	1.22E+00	(a)	(a)	(a)	(a)
Indeno(1,2,3-cd)pyrene	1.00E+02	2.38E+00	1.00E+02	2.65E+00	(a)	(a)	5.00E-01	3.23E-01
n-Nitrosodiphenylamine	(a)	(a)	(a)	(a)	(a)	(a)	6.00E-01	3.81E-01
Pentachlorophenol	(a)	(a)	(a)	(a)	4.00E+00	4.00E+00	(a)	(a)
Phenanthrene	4.90E+02	2.98E+00	4.90E+02	2.74E+00	(a)	(a)	(a)	(a)
Pyrene	3.60E+02	3.92E+00	3.60E+02	3.74E+00	(a)	(a)	1.40E+00	6.60E-01
bis(2-Ethylhexyl)phthalate	(a)	(a)	(a)	(a)	3.00E+00	3.00E+00	(a)	(a)
Pesticides/PCBs								
4,4'-DDD	(a)	(a)	(a)	(a)	(a)	(a)	7.30E-01	7.30E-01
4,4'-DDE	(a)	(a)	(a)	(a)	(a)	(a)	5.70E-01	5.70E-01
4,4'-DDT	(a)	(a)	(a)	(a)	(a)	(a)	4.20E-01	4.20E-01
Arochlor-1254	1.10E+00	5.67E-02	1.10E+00	6.00E-02	(a)	(a)	(a)	(a)
Arochlor-1260	3.40E-01	6.24E-02	3.40E-01	6.51E-02	(a)	(a)	(a)	(a)
Endrin ketone	7.10E-02	4.54E-03	7.10E-02	4.96E-03	(a)	(a)	(a)	(a)

TABLE 6-15

ECOLOGICAL COPCs

SEAD-16 Remedial Investigation
Seneca Army Depot

COPC	Surface Soil		Subsurface Soil		Surface Water		Sediment	
	Max Conc (mg/kg)	RME Conc (mg/kg)	Max Conc (mg/kg)	RME Conc (mg/kg)	Max Conc (ug/L)	RME Conc (ug/L)	Max Conc (mg/kg)	RME Conc (mg/kg)
Endosulfan I	(a)	(a)	(a)	(a)	(a)	(a)	2.60E-02	2.59E-02
Endosulfan II	(a)	(a)	(a)	(a)	(a)	(a)	6.80E-03	4.31E-03
Endosulfan sulfate	(a)	(a)	(a)	(a)	(a)	(a)	1.80E-02	7.58E-03
alpha-Chlordane	(a)	(a)	(a)	(a)	(a)	(a)	1.21E-02	8.44E-03
gamma-Chlordane	(a)	(a)	(a)	(a)	(a)	(a)	3.80E-03	2.38E-03
Herbicides								
MCPP	1.60E+01	4.33E+00	1.60E+01	4.33E+00	(a)	(a)	(a)	(a)
Metals								
Aluminum	(a)	(a)	(a)	(a)	2.61E+02	1.40E+02	2.29E+04	1.69E+04
Antimony	1.93E+03	4.77E+01	1.93E+03	5.12E+01	(a)	(a)	5.03E+01	5.03E+01
Arsenic	(a)	(a)	(a)	(a)	(a)	(a)	9.60E+00	7.39E+00
Barium	9.34E+03	4.11E+02	9.34E+03	3.66E+02	3.48E+02	1.54E+02	3.98E+03	2.53E+03
Beryllium	(a)	(a)	(a)	(a)	(a)	(a)	9.30E-01	6.95E-01
Cadmium	(a)	(a)	(a)	(a)	2.00E+00	1.39E+00	7.60E+00	4.55E+00
Chromium	(a)	(a)	(a)	(a)	(a)	(a)	4.35E+01	3.39E+01
Cobalt	(a)	(a)	(a)	(a)	4.24E+02	2.31E+00	1.56E+01	1.18E+01
Copper	3.79E+04	5.85E+02	3.79E+04	5.24E+02	(a)	(a)	1.75E+04	1.40E+04
Iron	(a)	(a)	(a)	(a)	3.65E+03	3.65E+03	4.64E+04	3.38E+04
Lead	1.40E+05	6.21E+03	1.40E+05	7.14E+03	8.13E+02	5.32E+02	4.48E+03	2.22E+03
Manganese	(a)	(a)	(a)	(a)	2.52E+02	2.17E+02	(a)	(a)
Mercury	1.14E+01	1.32E+00	1.14E+01	1.27E+00	9.00E-01	2.29E-01	2.50E+00	2.50E+00
Nickel	(a)	(a)	(a)	(a)	(a)	(a)	5.09E+01	4.04E+01
Selenium	1.60E+00	6.63E-01	1.60E+00	6.57E-01	4.30E+00	2.58E+00	4.90E+00	1.98E+00
Silver	(a)	(a)	(a)	(a)	5.20E+00	1.70E+00	(a)	(a)
Thallium	1.66E+01	9.97E-01	1.66E+01	1.32E+00	(a)	(a)	1.60E+00	9.31E-01
Vanadium	(a)	(a)	(a)	(a)	(a)	(a)	3.98E+01	3.14E+01
Zinc	1.46E+04	4.01E+02	1.46E+04	3.52E+02	3.80E+02	2.50E+02	9.52E+02	5.02E+02

(a) Constituent is not a COPC in this medium.

ditches of SEAD-16 were used to estimate exposure point concentrations in surface water (assuming a constant concentration over time) for both the current and future conditions. Sediment exposure point concentrations were estimated from measured concentrations of COPCs in sediment in the drainage ditches for both current and future conditions.

The same exposure point concentrations (EPCs) derived for the human health risk assessment were used as the RME concentrations for this ecological risk assessment. See Section 6.2.4 for a discussion of the calculations of EPCs, and Table 6-3 for a complete list of site EPCs.

6.6.2.2 Site Habitat Characterization

Site-specific data were compiled regarding the types of habitats and wildlife species found in the site vicinity. With the exception of fish collection for species identification, no biological sample collection or inventory was conducted for the Tier 1 ERA. The area considered likely to exhibit an interaction between elements of the local ecology and site-related contaminants occurs within a 2-mile radius of the site property. Due to land use patterns and geography within the 2-mile radius, evaluation of ecological resources and habitats is focused more on areas of potential exposure rather than on arbitrary distances or boundaries that lack a biological justification (EPA, 1989b). Multiple site visits were conducted during October 1996 to evaluate the habitat conditions within the radius of concern. A general evaluation of ecological resources and land use patterns within a 2-mile radius was conducted in conjunction with the site inspection. A general vegetative cover type map was prepared for areas within a 2-mile radius of the site and is presented in Figure 3-8. A more detailed vegetative cover type map of the 0.5-mile radius is presented in Figure 3-9. Observations and assessments were concentrated on undeveloped areas, waterways, and wetlands on and adjacent to the site. Vegetative classifications used in this assessment are based on NYSDEC Natural Heritage Program *Ecological Communities of New York State* (Reschke, 1990)

Information presented in this section was acquired by a combination of literature review, file searches, telephone interviews, office visits, and site inspection. Information was obtained from various departments of the NYSDEC including the headquarters in Albany, NY, the Region 8 offices in Avon NY, the Wildlife Resources Center in Latham, NY, the NYSDEC Bureau of Monitoring and Assessment Ambient Surface Water Monitoring Program, and the Rotating Intensive Basin Survey. Information was also obtained from the Albany headquarters of the New York State Department of Health (NYSDOH), the State University of New York College of Environmental Science and Forestry (SUNY ESF), Cornell University, the US Fish and Wildlife

Service (USFWS), the US Geological Survey Water Resources Division, and from publications of the Society of American Foresters. Site-specific resource information was acquired from the Seneca Army Depot *Natural Resources Management Plan* (SEDA, 1992c) and *Wetlands, Fish and Wildlife Plan* (SEDA, 1995). Regional information was obtained from the USGS 7 1/2 minute Romulus and Ovid, NY topographic maps; New York State Article 24 Freshwater Wetlands maps; the US Fish and Wildlife Service National Wetlands Inventory the US Department of Agriculture (USDA) Natural Resources Conservation Service (formerly, Soil Conservation Service); and the US Commerce Department *Climatic Atlas of the United States* (US Department of Commerce, 1983).

6.6.2.2.1 Regional Climate

Weather conditions in Seneca County exhibit seasonal fluctuations in temperature, precipitation, and prevailing winds. The climate in the region consists of moderately cold winters and warm, humid summers. The region exhibits a frost-free season of 135 days and a growing season of approximately 165 to 180 days (NOAA, 1990). Lake Ontario has a regional moderating effect on both daytime highs and nighttime low temperatures. Frost-free season length increases with proximity to the lake. Monthly precipitation in Seneca County is relatively uniform with no well-defined wet or dry seasons. The lightest precipitation commonly occurs in winter and the heaviest in late spring to midsummer. In 7 years in 10, total annual precipitation ranges from 26.5 to 37.5 inches. Rainfall during the May through September growing season is ordinarily 14.5 to 15.5 inches. Summer temperatures of 90°F or higher occur from 8 to 15 days in most years, mostly in June, July, and August. Average seasonal snowfall is 60 to 65 inches. Most days from early December through mid-March have at least 1 inch of snow cover on the ground (USDA, 1972).

6.6.2.2.2 Terrestrial Physical Characteristics

The Seneca Army Depot is situated due west of the village of Romulus, NY and 12 miles south of the villages of Geneva and Seneca Falls, NY. The site lies within the area described in the *Atlas of Forestry in New York* as the 1,400,000-acre Eastern Lake Plains region at the edge of the Allegheny Plateau (Society of American Foresters, 1973). The Allegheny Plateau exhibits irregular and broadly rolling topography in a complex pattern of high, rounded ridges flanked by steep, irregular valleys with elevations ranging from 500 to 2,500 feet. The Seneca Army Depot occupies 10,587 acres of a high, broad plateau separating Cayuga Lake, to the east, and Seneca

Lake, to the west. Topography across the depot slopes gently from 765 feet at the southeast corner to 585 feet at the northwest corner.

The SEAD-16 site consists of an essentially flat fill area measuring roughly 350 feet by 350 feet. The site is occupied by the abandoned deactivation furnace (building 311) and associated loading docks and outdoor storage lots. The surface of the site exhibits very poor soil development and consists mostly of gravel and crushed shale, along with concrete and asphalt pavement and railroad beds. Topography surrounding the site is graded essentially flat to facilitate railroad sidings and loading docks.

Four watersheds are present on the depot (USDA, 1989). Kendaia Creek drains the central portion of the site westward into Seneca Lake. Reeder Creek drains the northwest and north-central regions of the facility. The northeast portion of the site drains into Kendig Creek, which flows north into the Cayuga-Seneca Canal. The southern part of the depot is drained by Indian Creek, which empties into Seneca Lake near Sampson State Park. The SEAD-16 site is located in the headwaters region of the Kendaia Creek watershed.

The site is filled and graded, allowing no standing water to accumulate on the ground surface. Surface water runoff is collected primarily in a pair of ditches that flow parallel to the railroad tracks southeast of the site and a swale running due south from the site, parallel with the ammunition area perimeter fence. The two primary drainages are each tributary to Kendaia Creek at a point approximately 700 to 800 feet south of the site fence, respectively. A secondary ditch, 100 feet east of the site fence, collects drainage from the meadow area on the east side of the site, and is tributary to the ditches along the railroad tracks. Surface water was observed, through one of the open bay doors in the building's basement, to have flooded the building's interior to a depth of approximately two to three feet.

6.6.2.2.3 Land Use and Vegetative Cover

Land use at the depot is controlled by the facility mission. The entire facility has restricted access and is surrounded by chain-link fencing topped with barbed wire. The depot has a roadway network consisting of paved macadam, concrete, and gravel roads totaling approximately 141 miles.

Land use is divided into three categories at the depot. The Main Post accounts for 9,832 acres and consists of an exclusion area containing partially buried, reinforced concrete igloos, general storage magazines, and warehouses. The cantonment areas of the facility consist of the North and South Posts. The North Post, at the north end of the Main Post, includes troop housing, troop support, and community services. The South Post is located in the southeast portion of the facility near Route 96 and is a developed area containing warehouses, administration buildings, quarters, and community services.

SEAD-16 is located at the western edge of the South Post area and adjoins the Main Post (ammunition area) perimeter fence. Land use at SEAD-16 consists of an abandoned building, storage lots, and derelict structures. Access to the site is restricted by perimeter chain link fencing.

The vegetative communities within the 0.5-mile study area are predominantly upland cover types unevenly distributed among the developed areas of the South Post. Vegetation and land use within the 0.5-mile radius study area are depicted in Figure 3-9. Cover types include mown lawns, old fields, shrublands, and deciduous forest. Unvegetated areas consist of open storage lots, railroads, paved roads, and buildings. Unvegetated corridors are maintained by herbicide application along the railroad tracks adjacent to the site.

On-site vegetation is sparse. Only a few specimens of common weeds have been able to establish root systems in the compacted fill soils at the site. No shrub or tree strata are present. Vegetation consists of grasses and early successional herbaceous species, primarily spotted knapweed (*Centaurea maculosa*), orchard grass (*Dactylis glomerata*), and various other grasses. These species occupy approximately 5 percent of the ground surface of the site. A listing of observed plant species and community associations at the site and within the 0.5-mile study area is presented in Table 3-4.

The types and distribution of vegetative communities surrounding the site result from decades of human modification of the environment of South Post and the ammunition area (Main Post) (SEDA, 1992a, c). Mowing, drainage diversion, building construction, landscaping practices, forestry practices, plantations, and herbicide application all control the composition of vegetation surrounding the site. The following sections describe the vegetation and ecological community types that were observed within the 0.5-mile study area. Classification of the communities is presented consistent with the approach presented in *Ecological Communities of New York State* (Reschke, 1990).

Upland Forest Communities

Appalachian Oak-Hickory Forest. This cover type represents a relatively minor component within the 0.5-mile study area in small, undisturbed remnant forests, bisected by ammunition area roads. These forests usually exhibit nearly complete canopy cover; abundant mast-bearing trees; and a shaded, sparse understory. The oak-hickory forests within the subject area are composed of northern red oak (*Quercus rubra*), white oak (*Quercus alba*), shagbark hickory (*Carya ovata*), and black walnut (*Juglans nigra*). The shrub stratum is dominated by saplings of these species as well as red maple (*Acer rubrum*), hawthorn (*Crataegus* sp.), butternut (*Juglans cinerea*), and vines of wild grape (*Vitis* sp.), poison ivy (*Toxicodendron radicans*), and raspberry (*Rubus idacus*).

Successional Northern Hardwoods. Successional northern hardwoods are present in areas where sufficient time has elapsed since disturbance to facilitate the development of a dense overstory canopy (75 percent cover). Particularly even-aged stands of red maple within this forest type are possibly deliberate plantations. Dominant overstory trees are red maple, eastern cottonwood (*Populus deltoides*), and northern red oak.

Conifer Plantation. The single occurrence of this vegetation type consists of a tamarack (*Larix laricina*) monoculture plantation located between the ammunition area roads B9 and C1, near the western fringe of the 0.5-mile radius. Small diameter tamaracks closely spaced at intervals occupy a plot in the area between the roadways. Close spacing and invasion of the understory by oldfield species appears to be limiting the prospects for this stand to mature into a significant covertype. While some scattered tamarack are present in surrounding cover types, they are apparently not vigorous enough to compete with fast-growing oldfield species and are exhibiting sparse new growth.

Deciduous tree plantation. Plantations of butternut and red maple appear to have been planted in the past, probably to create vegetative diversity and forage. Butternut stands, because of phytotoxins in the husks of their fruit, deter plant growth and exhibit a suppressed understory. Much of the shrub layer under the butternuts consists of only one species, raspberry, which appears to tolerate the altered soil chemistry.

Terrestrial Cultural Communities

Paved Roads and Mowed Roadside. Each of the ammunition area roadways has a paved width of 12 feet and has a mown and cleared margin of approximately 30 feet in width. Vegetative growth along site roads is maintained by mowing to provide suitable visibility and access, and to serve as fire breaks. No overstory or shrub layer is present within 30 feet of each edge of the asphalt pavement. Herbaceous growth is limited to grasses, sedges, and forbs able to withstand several mowings through the growing season.

Abandoned Structure Interior/Exterior. The abandoned building at SEAD-16 provides nesting habitat for barn swallows, roosting sites for bats, and shelter for small mammals. No other habitat utilization of the abandoned building was observed. The basement of the building was flooded to a depth of 1 to 2 feet at the time of the inspection and it is suspected that the conditions observed prevail throughout much of the year. Amphibians may be utilizing the flooded portions of the basement but full inspection of the flooded interior was not conducted.

Ore Piles. Large ore piles consisting of ferro-manganese boulders/cobbles are present along the railroad sidings nearly 0.5 mile from the site. These ore piles offer no substrate for vegetation and are generally barren. Interstices near the ground surface may be exploited as shelter by small mammals. No significant habitat opportunities are otherwise offered in and around the ore stockpiles.

Railroads. Railroad tracks in the vicinity of the site were observed as being hunting grounds of red-tailed hawk and great horned owl during the field visits. Prominent perches adjacent to railroad corridors were occupied by these birds frequently during the site visits. Railroads apparently serve as trails for nocturnal creatures, as tracks and scat of skunk, raccoon, fox, and opossum were observed frequently. Poor rooting substrate and herbicide application suppress vegetation along the tracks and shoulders.

Palustrine Communities

The revised NYSDEC 1985 Article 24 Freshwater Wetlands map (Ovid, NY quadrangle) and USFWS National Wetlands Inventory (USFWS, 1991) map identify 32 freshwater wetlands within a 1-mile radius of the site. These wetlands are shown in Figure 3-10.

The nearest wetland (OV-8) identified on the 1985 NYS Article 24 Freshwater Wetlands map is located approximately 2,000 feet downstream, west of the site. Another NYS designated wetland (OV-5) occurs within the 0.5-mile radius study area, but is located outside the perimeter fence and occurs in an apparently upgradient position located on the opposite side of Route 96 from the SEAD property. A portion of NYS designated wetland OV-7 occurs within 1 mile of the site.

The USFWS NWI map depicts four wetland environments within 0.5 mile of the site and an additional 25 wetlands within a 1-mile radius. Wetlands systems within the 1-mile radius consist of palustrine forested, scrub-shrub, and emergent vegetative types and open water wetlands exhibiting several vegetative subclasses and hydrologic regimes.

Shallow emergent marshes, forested wetlands, and shrub swamps are depicted on Figure 3-10. Palustrine emergent marshes within 0.5 mile of the site are limited to the fringes of streams and ditches and result from diversion of naturally occurring drainage patterns. Forested wetlands result from disruption of local drainages and flooding caused by beaver dams.

Riverine Communities

The headwaters of Kendaia Creek are present in the site vicinity, approximately 800 feet to the south of SEAD-16. The creek is a first-order stream with a modified dendritic drainage pattern that drains to the west, across the ammunition area, then into Seneca Lake at Pontius Point. The upper reaches of Kendaia Creek have been modified (channeled and straightened) to facilitate better surface water runoff from the South Post. Unnamed tributaries from the SEAD-16 site contribute to the upper reaches of Kendaia Creek at the point where the creek enters the Ammunition Area (Main Post) from the South Post.

The watershed land use at the headwaters of the creek (South Post) is low-density industrial complex with maintained grades, stable soils, and adequate storm sewers, with little erosion potential. Further downstream, development is limited to ammunition storage bunkers in the ammunition area (Main Post). Approximately 500 feet downstream of the ammunition area/South Post fence, the creek is impounded by a series of three beaver dams.

Ditch/Artificial Stream. Kendaia Creek exhibits markedly different physical characteristics in modified and undisturbed sections. The upper, channelized sections are lined with steep unconsolidated banks of crushed shale fill. Canopy cover in the channelized portion is absent. Estimated stream width varies from 10 to 20 feet with depths ranging from 2 to 4 feet. Less than 10 percent of the substrate consists of rubble, gravel, or other stable habitat. Due to a series of three beaver dams downstream, the upper reaches of the creek are impounded into a pool condition dominated by a uniform velocity/depth category. Emergent vegetation occupies the inundated sections and a sparse shrub cover is present along the banks. The shale-fill banks end abruptly approximately 500 feet downstream of the South Post fence. This is the location of the first of a series of active beaver dams impounding water in this section of creek and the point where stream morphology changes greatly. The dams flood the forest along both banks of the creek .

Rocky Headwater Stream. The sections downstream of the first series of beaver dams differ in flow, depth, substrate, and canopy. Water velocity is greater, producing a scouring effect exposing shale bedrock, cobbles, pebbles, and coarse sands. Pools are small and shallow and most of the run is dominated by riffles. The canopy over the unmodified sections of the creek is dense and the banks are firmly anchored by a dense growth of shrubs. Organic matter consists chiefly of coarse leaf litter.

6.6.2.2.4 Aquatic Resources

Minnow traps deployed in the modified ditch, constituting the headwaters of Kendaia Creek, captured specimens of creek chub (*Semotilus atromaculatus*) and bluegill sunfish (*Lepomis macrochirus*). Captured creek chubs (17 specimens) ranged from 1.3 to 6 inches total maximum length. Ten bluegill sunfish captured ranged from 1 to 3 inches total length. These species were also observed in the downstream reaches. Creek chub also were observed in an unnamed tributary ditch of Kendaia Creek that runs parallel to the railroad siding leading to the gate at SEAD-16. Chubs were observed as far upstream in this ditch as the gate leading into the site. Tracks of piscivorous wading birds, probably great blue heron (*Ardea herodias*) and green-backed heron (*Butorides striatus*), were observed on the creek banks. Wood ducks (*Aix sponsa*) were observed in the pool area near the beaver dams. Green frog (*Rana clamitans melanota*) and northern leopard frog (*Rana pipiens*) were observed in various locations. Small fish were abundant in the upper reaches of the creek.

6.6.2.2.5 Stressed or Altered Vegetation

No adverse ecological effects were identified at the site that could be directly attributed to chemical contaminants. Direct evidence of contaminant stress on individual plants was not observed in the study area. No evidence of stunted, dead, or chlorotic vegetation was observed in the subject area. Examination of nearby surface waters yielded no indication of unusual colors, odors, precipitates, staining, or sheens. Natural gradients of plant succession and community composition would not be expected to be visible under the highly disturbed conditions prevalent at the site. It is therefore not possible to evaluate contaminant impacts in terms of vegetation type, abundance, or distribution. Bare areas scattered elsewhere on the site appeared directly attributable to very poor soil development in the surficial fill and are not considered a result of contaminant effects. No seeps or outbreaks of contaminated site drainage were noted along the perimeter of the site.

6.6.2.2.6 Wildlife Resources

Wildlife resources at the Seneca Army Depot are intensively managed under a cooperative conservation and development plan developed in conjunction with the NYSDEC (1992). The objectives of the fish and wildlife management plan are to:

a. protect and develop habitat for the production of game and non-game species;
b. control white-tailed deer (*Odocoileus virginianus*) harvest (with additional emphasis on white-tailed deer management);
c. enhance non-game species populations for their aesthetic, recreational, and educational values; and
d. establish long range goals for selected species including eastern bluebird (*Salia salis*), ring-necked pheasant (*Phasianus colchicus*), wood duck, white-tailed deer, and wild turkey (*Meleagris gallopavo*).

Commonly occurring small game mammals within the Main Post include eastern cottontail rabbit (*Sylvilagus floridanus*), gray squirrel (*Sciurus carolinensis*), raccoon (*Procyon lotor*), snowshoe hare (*Lepus americanus*), muskrat (*Ondatra zibithecus*), beaver (*Castor canadensis*), eastern coyote (*Canis latrans*), red fox (*Vulpes vulpes*), and gray fox (*Urocyon cinereoargenteus*). Ruffed grouse (*Bonasa umbellus*), ring-necked pheasant, and wild turkey also inhabit the depot. Waterfowl are attracted to wetlands on and around the depot, particularly the 87-acre "duck ponds" created in the northeast corner of the property during the 1970s.

The wildlife within 0.5 mile of the site consists of upland species, particularly those favoring old fields and shrublands and freshwater wetlands since these are abundant habitats in the study area. The mixture of these habitats with small woodlots and tree rows provides ideal habitat for white-tailed deer, which are common throughout the depot. Many non-game species also are present in the depot and potentially utilize habitats within the 0.5-mile study area.

Tracks, presumed to be of eastern coyote, coy-dog, or feral dog, were observed along the railroad sidings, west of the site. (While their tracks are often indistinguishable, no domestic dogs remain on the South Post since base closure.) Tracks of white-tailed deer, raccoon, and rabbit also were observed adjacent to the site. Wildlife evidence and direct observations made during site visits are presented in Table 3-4.

6.6.2.2.7 Endangered Species and Significant Habitats

The NYSDEC Natural Heritage Program Biological and Conservation Data System identifies no known occurrences of federal- or state-designated threatened or endangered plant or animal species within a 2-mile radius of the site. No species of special concern are documented within the depot property. Field investigation of the site determined that the surrounding area is highly modified and has a disturbed ecology resulting from management consistent with mission activities. Highly disturbed sites are characteristically colonized by pioneer species and agricultural “weeds” and do not typically support rare or endangered species. No rare or endangered plant species were observed during the site reconnaissance.

6.6.2.2.8 Habitat Assessment

Resource Values to Wildlife

The 9,832-acre Main Post is the focus of wildlife and forestry management practices being conducted at the depot. Wildlife management efforts focusing on waterfowl, songbirds, and game populations have been conducted for many years.

Overall, the small and highly-dissected meadow, forest, and oldfield habitats in the study area provide marginal habitat value. Extensive development and human traffic within the South Post likely deter wildlife utilization. Proximity to extensive mixed cover types of the Main Post probably enhances these habitats as foraging areas somewhat, and contributes diversity to the local environment.

The South Post is largely developed land that experiences indirect effects of the Main Post wildlife management strategies. For example, while the Main Post and South Post are separated by a chain link fence, breaches in the fence were observed to provide access to nocturnal grazing areas on South Post. White-tailed deer move to the South Post to graze lawns and gardens at night and return to the relative safety of the Main Post during the daylight hours. Many small mammals probably find the fencing no great barrier and may forage in a similar manner. Wildfowl and songbirds also may seek the Main Post solitude during the mid-day and seek foraging opportunities in the South Post during the early morning and evening. Landscaped lawns with exotic plantings, bird feeders, and garbage dumpsters offer foraging opportunities not available in the undeveloped Main Post. Wildlife management practices on the Main Post therefore have a spillover effect into the 0.5-mile study area of this ERA.

Wildlife and aquatic life that were observed within the 0.5-mile radius are presented in Table 3-4 In general, common wildlife species exploiting oldfield, successional forest, mature hardwood forest, and wetlands potentially occur within 0.5 mile of the site. Kendaia Creek and unnamed tributaries occur within the radius of concern and support a permanent aquatic community.

The habitat value of the SEAD-16 site itself is considered marginal. The surrounding perimeter fence excludes large mammals such as white-tailed deer, fox, and coyote. The gate over the access road reaches to within 6 inches of the ground surface and offers access by small mammals such as rabbits, raccoons, and woodchucks (*Marmota monax*). No burrows were observed on the site. Mice, voles, and shrews would not be excluded by the perimeter fence. No mature trees are available for bird nesting or for dens. Ground-nesting birds preferring exposed gravel substrates, such as killdeer (*Charadrius vociferus*) may find suitable nesting conditions on the site, whereas tall grasses are too sparse to offer nesting habitat for ground nesters requiring concealment. Abundant evidence (scat) of small mammals was observed in and around the derelict deactivation furnace building and in the pallet yard outside the fence. Human activity on and around the site probably discourages habitat utilization by some species.

Resource Value to Humans

The Seneca Army Depot represents a unique opportunity for wildlife and pest control research in New York state due to its large size and continuous perimeter fencing. The depot property represents significant value to humans resulting from decades of wildlife management and scientific research. The NYSDEC has used the depot white-tailed deer population to develop population, growth, and reproduction models. Currently a 3-year Cornell University/NYSDEC white-tailed deer immuno-contraception study is being conducted with a captive herd in the Q area of the Main Post. NYSDEC biologists participate in annual harvests by inspecting field-dressed deer for disease and parasites, aging specimens, and measuring beam diameter (SEDA, 1992c). NYSDEC conducted studies in the 1960s on fox reproduction inhibition using diethyl stilbestrol (DES) to control the spread of rabies. Cornell University entomologists have conducted studies on the ability of northern corn rootworm to traverse areas of non-croplands at the depot (SEDA, 1992c).

Consumptive use of wildlife consists of hunting of upland birds, predators, waterfowl, and white-tailed deer. Harvest of deer is closely monitored to maintain the population below carrying capacity of the depot habitat (SEDA, 1995). Hunting on the property is presently limited to current and retired military personnel and limited numbers of guests. Hunting is conducted during both the Southern Zone archery and firearms hunting seasons in accordance with New York state regulations. Discontinuation of the military mission of the depot may have significant impacts on the types and intensity of human utilization of wildlife resources in the future.

The consumptive wildlife resource value of the SEAD-16 property to humans is considered non-existent, due to the depot being posted and patrolled against unauthorized entry. Additionally, land use in the immediate vicinity of SEAD-16 is inconsistent with consumptive wildlife uses by the general public. Future use scenarios for the South Post property (excluding complete abandonment) are not likely to increase the suitability of habitat or wildlife resource value in the vicinity of SEAD-16.

Currently much of the South Post is vacant and access to the depot is still restricted, thus limiting participation in non-consumptive wildlife uses. Evidence of non-consumptive wildlife resource utilization, such as bird watching, wildlife observation, photography, and amateur study, was not observed during the site inspection but is presumed to occur in the study area. The white-tailed deer population is an unusual herd that has an important aesthetic value. Due to breaches in the Main Post fence, white-tailed deer can be commonly observed in the South Post.

The drainages adjacent to the site do not provide exploitable fisheries resources. No recreational fishing resources are utilized within the 0.5-mile study area.

6.6.2.3 Ecological Assessment Endpoint(s)

EPA's draft *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (EPA, 1994b) states that the selection of assessment endpoints depends on the following:

1. The constituents present and their concentrations,
2. Mechanisms of toxicity to different groups of organisms,
3. Potential species present, and
4. Potential complete exposure pathways.

The constituents and concentrations are discussed in detail in Section 4. Mechanisms of toxicity are evaluated conceptually in the analysis plan in Section 6.6.2.4. Potential species present are discussed in Section 6.6.2.2 and receptor selection is presented in Section 6.6.2.3. Potential complete exposure pathways are part of the ecological conceptual site model in Section 6.6.2.3.

To assess whether significant adverse ecological effects have occurred or may occur at SEAD-16 as a result of ecological receptors' exposure to COPCs, ecological endpoints were selected. An ecological endpoint is a characteristic of an ecological component that may be affected by exposure to a stressor, such as a chemical. Assessment endpoints represent environmental values to be protected and generally refer to characteristics of populations and ecosystems (EPA, 1994b). Unlike the human health risk assessment process, which focuses on individual receptors, the ERA focuses on populations or groups of interbreeding non-human, non-domesticated receptors. In the ERA process, risks to individuals are assessed only if they are protected under the Endangered Species Act, as well as species that are candidates for protection or are considered rare.

Given the diversity of the biological world and the multiple values placed on it by society, there is no universally-applicable list of assessment endpoints. Therefore, EPA, in the *Proposed*

Guidelines for Ecological Risk Assessment (EPA, 1996a) has suggested three criteria that should be considered in selecting assessment endpoints suitable for a specific ecological risk assessment. These criteria are: ecological relevance, susceptibility to the contaminant(s), and representation of management goals.

- Ecological relevance. The assessment endpoint should have biological/ecological significance to a higher level of the ecological hierarchy. Relevant endpoints help sustain the natural structure, function, and biodiversity of an ecosystem. For example, an increase in mortality or a decrease in fecundity of individuals is ecologically significant if it affects the size or productivity of the population. Likewise, a decrease in the size of a population is ecologically significant if it affects the number of species, the productivity, or some other property of the ecosystem.
- Susceptibility to the contaminant(s). The assessment endpoint should be susceptible to exposure to the contaminant(s) and should be responsive/sensitive to such exposure. That is, assessment endpoints should be chosen that are likely to be exposed to contaminants at the site, either directly or indirectly (e.g., through the food chain), and they should be sensitive enough that such exposure may elicit an adverse response. Ideally, this sensitivity should be at such a level that other site-related receptors of potential concern are adequately protected under the selected endpoint's response threshold.
- Representation of management goals. The value of a risk assessment depends on whether it can support quality management decisions. Therefore the assessment is based on values and organisms that reflect management goals. The protection of ecological resources (e.g., habitats and species of plants and animals) is a principal motivation for conducting ERAs. Key aspects of ecological protection are presented as policy goals, which are general goals established by legislation or agency policy based on societal concern for the protection of certain environmental resources. For example, environmental protection is mandated by a variety of legislation and government agency policies (e.g., CERCLA, National Environmental Policy Act). Other legislation includes the Endangered Species Act, 16 U.S.C. 1531-1544 (1993, as amended) and the Migratory Bird Treaty Act, 16 U.S.C. 703-711 (1993, as amended). Table 6-16 shows the policy goals established for the site. To determine whether these protection goals are met at the site, assessment and measurement endpoints are formulated that define the specific ecological values to be protected and the degree to which each may be protected.

Given the small size of the site and its disturbed condition, it does not provide habitat for many species. The site ecological characterization concluded that SEAD-16 does not provide habitat for any threatened or endangered species; therefore, the assessment endpoint of no reduction in numbers of any threatened/endangered species is met. However, the field survey concluded that the site is likely to be used by small mammal populations and by fish populations in the site ditches. Accordingly, the assessment endpoint that has been selected to represent the policy goal of protection of terrestrial populations and ecosystems is "no substantial adverse effect on survival, growth, and reproduction of resident mouse populations." The survey of the surface water bodies at the site found creek chub living in the stream. The assessment endpoint selected to represent the policy goal of protection of aquatic populations and ecosystems is "no substantial adverse effect on survival, growth, and reproduction of resident fish populations."

6.6.2.3.1 Receptor Selection

Potential receptor species likely to be exposed to site-related contaminants were judged by the criteria identified in Section 6.6.2.3 as part of the assessment endpoint selection process. That is, receptors were selected to represent assessment endpoints based principally on their importance in the community food web; their susceptibility (through exposure and sensitivity) to the site-related constituents, the amount of available data describing their potential for exposure, and the toxicological effects that may result from exposure; and the extent to which they represent management goals. The results of this analysis indicate that native mouse species inhabiting the area of SEAD-16 are the most appropriate receptor species for soil, and the relevant assessment endpoint was defined as "no substantial adverse effect on resident mouse populations." Given the predominately herbaceous nature of the site, the deer mouse (*Peromyscus maniculatus*) was selected as the species with the niche best met by conditions present at the site. For the aquatic ecosystems, the native fish species in the streams were determined to be the most appropriate receptor species for surface water and sediment, and the relevant assessment endpoint was defined as "no substantial adverse effect on resident fish populations." The creek chub was selected as the species best representing the resident fish populations in the site streams.

While SEAD-16 is relatively poor habitat for mammals, deer mice have been observed at the site. These are the vertebrate receptors most likely to be maximally exposed to contaminants in soil at the site. They also represent a significant component of the food chain, feeding on seeds and berries and soil invertebrates and providing prey for predators. Therefore, the deer mouse was selected as the receptor species at this site and measures of effects (measurement endpoints) were selected that could be extrapolated to predict effects on the assessment endpoints. Data bases and available literature were searched for toxicity data for deer mice or other native rodent species. In the absence of site-specific data, laboratory-derived data on mortality or reproductive effects were used as measurement endpoints. In the absence of data on native species, data for laboratory rodents such as laboratory mice (*Mus musculus*) and laboratory rats (*Rattus norvegicus*) were used.

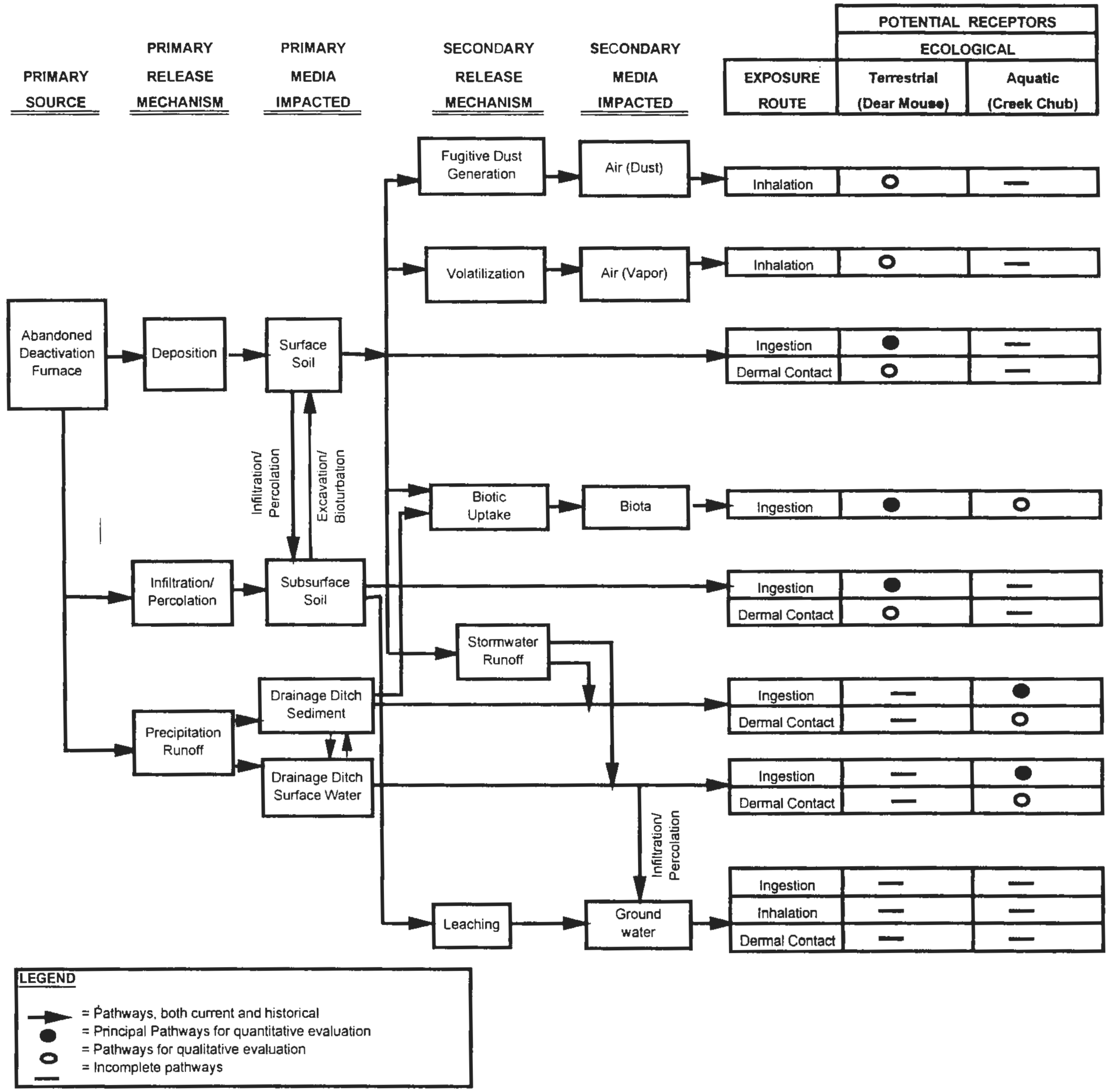
6.6.2.3.2 Ecological Conceptual Site Model

The conceptual site model (CSM) presents the ecological receptors at SEAD-16 that are potentially exposed to hazardous substances in soil across several pathways (Figure 6-7). A complete exposure pathway consists of the following four elements:

- A source and mechanism of contaminant release to the environment
- An environmental transport mechanism for the released contaminants
- A point of contact with the contaminated medium
- A route of contaminant entry into the receptor at the exposure point.

If any of these elements is missing, the pathway is incomplete and is not considered further in the ERA. A pathway is complete when all four elements are present and permit potential exposure of a receptor to a source of contamination. Quantification of some potentially complete pathways may not be warranted because of minimal risk contribution relative to other major pathways. The dominant pathways from sources and exposure media through the food web to ecological receptors potentially exposed to ecological COPCs at the site are presented in Figure 6-7.

Figure 6-7 Ecological Conceptual Site Model
SEAD-16 RI
SENECA ARMY DEPOT ACTIVITY



	POTENTIAL RECEPTORS	
	ECOLOGICAL	
EXPOSURE ROUTE	Terrestrial (Dear Mouse)	Aquatic (Creek Chub)
Inhalation	○	—
Inhalation	○	—
Ingestion	●	—
Dermal Contact	○	—
Ingestion	●	○
Ingestion	●	—
Dermal Contact	○	—
Ingestion	—	●
Dermal Contact	—	○
Ingestion	—	●
Dermal Contact	—	○
Ingestion	—	—
Inhalation	—	—
Dermal Contact	—	—

The CSM will serve as a conceptual hypothesis for the exposure characterization, the objective of which is to gather information from which to determine the pathways and media through which ecological receptors may be exposed to COPCs. The exposure characterization typically involves determining the following (EPA, 1994b):

1. The ecological setting of the site
2. The inventory of constituents that are or may be present at the site
3. The extent and magnitude of the constituent concentrations present, along with spatial and temporal variability of those concentrations
4. The environmental fate and transport of the constituents.

The ecological setting is described in Section 6.6.2.2 and the inventory of extent and magnitude contaminants is presented in Section 4 on Nature and Extent of Contamination. Environmental fate of the COPCs and the potential exposure pathways are discussed in the following paragraphs.

The primary sources of contaminants in SEAD-16 are the residues that remained after activities at the deactivation furnace. The wastes handled at the site are listed in the human health BRA. The primary release mechanisms are deposition of ash from waste-burning and inadvertent deposition of waste materials on surface soils. Contamination, if present, can migrate due to bioturbation or excavation. Volatile compounds can move through the soils. Infiltrating rainwater can leach contaminants and transport them into groundwater, and surface water runoff can also carry contaminants onto adjacent soils or drainage ditches.

Exposure to surface soil contaminants may occur directly through ingestion, inhalation, and/or dermal contact. Chemicals also may migrate further in the environment by a variety of pathways following secondary release from surface soil and deeper soil. The following pathways result from these secondary release mechanisms:

- Suspension and dispersal by the wind of particulate contaminants or contaminants adsorbed to surface soil particles
- Direct volatilization of volatile organic compounds from surface soil to air
- Uptake of soil contaminants by terrestrial organisms
- Transport of chemicals to surface water and sediment by surface runoff of water and soil particles

- Uptake of surface water and sediment contaminants by aquatic organisms.

As shown in the CSM, there are five media through which ecological receptors could be exposed to site-related contaminants: air (dust and vapor), soil, surface water, sediment, and organisms in the food chain. An exposure point is a location where a receptor could potentially come into contact with a contaminated medium. An exposure route is the means by which a receptor comes into contact with a contaminated medium at an exposure point. Exposure to COPCs may occur through the routes of ingestion, inhalation, and dermal contact.

Probable exposure routes (i.e., potentially complete pathways) were identified for each medium based on the physical characteristics of the site and the potential ecological receptors that may occur there (see the previous description of the ecological setting). Exposure routes were also identified for ecological receptors. Principal pathways for which analytical data were available for quantitative evaluation of soil COPCs include: ingestion of soil and ingestion of other animals and plants that have accumulated contaminants. For sediment and surface water, principal pathways include direct contact with surface water and sediment, ingestion of surface water and sediment, and ingestion of other organisms that have accumulated contaminants.

Terrestrial animals could potentially be directly exposed to soil contaminants through ingestion of, dermal contact with, and/or inhalation from site soils. For species such as deer, raccoon, opossum, rabbits, rodents, and birds, such exposures would likely be associated with foraging activities. Burrowing species, such as rabbits, mice, moles, and shrews, would probably receive the greatest exposures among vertebrates. Invertebrates living on and within the soil also may experience significant exposures. Although ingestion is the principal soil exposure route, dermal contact also may be important, particularly for burrowing species. However, the limited dermal permeability data base available for ecological receptors and surrogate species precluded quantitative evaluation of the dermal exposure pathway.

Ecological receptors could potentially be exposed to site-related contaminants via the air medium. Contaminants in air may be in the form of vapor from volatile organic compounds, or in particulate form (as dusts or adsorbed to soil particles) suspended by wind. In either form, ecological receptors could be exposed to contaminants through inhalation. However, the lack of applicable inhalation toxicity data for ecological receptors or similar species precluded quantitative evaluation of potential risks.

Aquatic biota could be directly exposed to surface water and sediment contaminants through ingestion of and dermal and gill contact with surface water and sediment in the site ditches. Predators could also ingest contaminated biota.

Plants may be considered ecological receptors as well as a pathway or medium through which wildlife receptors can be exposed to contaminants. Plants may absorb site-related contaminants from soil through their roots. Contaminants absorbed by plants may then be transferred to wildlife when the plants are ingested for food. This exposure pathway was addressed by use of chemical-specific soil-to-plant uptake factors (obtained from the scientific literature) in the animal receptor exposure calculations. No plants on or near the site showed visible signs of stress during the field reconnaissance.

Under the future land use scenario for SEAD-16, it is assumed that contaminated soils would be excavated during construction and distributed on the ground surface. As under current conditions, ecological receptors could potentially be exposed to chemicals in soil through ingestion and dermal contact. Other exposure pathways also were assumed to remain essentially the same as under current conditions, except that possible inhalation exposures are likely to be reduced by paving and vegetation (e.g., lawns). The abundance and diversity of some ecological receptors on the site may likely be reduced due to the development.

6.6.2.4 Analysis Plan

The analysis plan is the final stage of problem formulation. In this step, risk hypotheses presented in the CSM are evaluated to determine how these hypotheses will be assessed using site-specific data. The analysis plan includes three categories of measures to evaluate the risk hypotheses identified in the CSM: measures of effect (also termed measurement endpoints), measures of exposure, and measures of ecosystem and receptor characteristics.

6.6.2.4.1 Measures of Effect

Measurement endpoints are measurable responses to a stressor that are related to the valued characteristics chosen as assessment endpoints (EPA, 1992). Assessment endpoints generally refer to characteristics of populations and ecosystems. It is usually impractical to measure changes in these characteristics as part of an assessment. Consequently, measurement endpoints are selected that can be measured and extrapolated to predict effects on assessment endpoints

(EPA, 1992). The most appropriate measurement endpoint relating to the assessment endpoint is the lowest concentration of the constituent that, in chronic toxicity tests, is associated with non-lethal effects to a deer mouse or creek chub. Because the assessment endpoint focuses on maintenance of populations of deer mice and creek chubs, a measure of effect equivalent to "no effect" would be overly conservative, in that it would reflect protection of the individual, not the population. A more appropriate measure of effect, reflecting population level response, is the lowest non-lethal effect level. Toxicity data from tests that measure responses that influence reproduction, health, and longevity of the mouse and fish will conform with the assessment endpoint. Therefore, the lowest concentration of the constituent that produces such effects will be used as a measure of effects.

Reliable measures of effects are not available for each exposure route for each constituent. Effects from exposure through inhalation and dermal contact are not well developed for ecological receptors; consequently, these exposure routes are analyzed qualitatively.

The measures of ecosystem and receptor characteristics include such characteristics as the behavior and location of the receptor and the distribution of a contaminant, both of which may affect the receptor's exposure to the contaminant. The typical foraging area of the receptor as well as the quality of the habitat in the site have been considered in the estimation of exposure, as discussed in Sections 6.6.3.2 and 6.6.3.3.

6.6.2.4.2 Measures of Exposure

Measures of exposure are the amounts, in dosage or concentration, that the receptors are hypothesized to receive. These include concentrations of constituents in the impacted media and concentrations or dosages of the constituents to which the receptor is exposed.

Decision rules are specified for evaluating effects on the assessment endpoints. Table 6-16 shows the decision rules that describe the logical basis for choosing among alternative actions for the assessment endpoints based on the results of the measurement endpoints. Together, the assessment endpoint, measurement endpoint, and decision rule define the following:

- An entity (e.g., deer mouse or creek chub population)
- A characteristic of the entity (e.g., health of the individuals in the population)

TABLE 6-16

POLICY GOALS, ECOLOGICAL ASSESSMENT AND MEASUREMENT ENDPOINTS AND DECISION RULES FOR SEAD-16

SEAD-16 Remedial Investigation
Seneca Army Depot

Policy Goals	Assessment Endpoint	Measurement Endpoint	Decision Rule
Policy Goal 1: The conservation of threatened and endangered species (TES) and their critical habitats	**Assessment Endpoint 1:** No reduction in numbers of any state- or federally-designated TES	**Measurement Endpoint 1:** Biosurveys for TES plants and animals; COPC concentration in physical media and predicted concentration in prey species	**Decision Rule for Assessment Endpoint 1:** If TES are not present, or COPC RME concentrations in the media do not exceed toxicity screening thresholds or dietary NOAELS (i.e., HQ<1), the assessment endpoint is met and TES are not at risk
Policy Goal 2: The protection of terrestrial populations and ecosystems	**Assessment Endpoint 2:** No substantial adverse effect on populations of small mammals (i.e., deer mouse)	**Measurement Endpoint 2:** Lowest chronic, dietary, non-lethal effect level of COPCs on mice	**Decision Rule for Assessment Endpoint 2:** If ratios of estimated exposure concentrations predicted from COPC RME concentrations in soil to dietary limits corresponding to LOAEL toxicity reference values for adverse effects on deer mice (HQs) are <1, then Assessment Endpoint 2 is met and small mammals are not at risk
Policy Goal 3: The protection of aquatic populations and ecosystems	**Assessment Endpoint 3:** No substantial adverse effect on populations of aquatic animals (i.e., creek chub)	**Measurement Endpoint 3:** Lowest chronic non-lethal concentration of COPCs on fish	**Decision Rule for Assessment Endpoint 3:** If ratios of estimated exposure concentrations predicted from COPC RME concentrations in sediment and surface water to LOAEL toxicity reference values for adverse effects on fish (HQs) are <1, then Assessment Endpoint 3 is met and aquatic organisms are not at risk

COPC = constituent of potential concern.
TES = threatened and endangered species.
NOAEL = no observed adverse effect level.
LOAEL = lowest observed adverse effect level.
RME = reasonable maximum exposure.
HQ = hazard quotient.

- An acceptable amount of change in the entity (e.g., loss of no more than 20 percent of a population)
- A decision whether the protection goal is or is not met.

The results of the assessment will be presented in terms of hazard quotients (HQs). The HQ is the ratio of the measured or predicted concentration of an ecological COPC to which the receptors are exposed in an environmental medium, and the measured concentration that adversely affects an organism based on a toxicity threshold. If the measured concentration or estimated dose is less than the concentration or dose expected to have the potential to produce an adverse effect (i.e., the ratio of the two is less than 1), the risk is considered acceptable (protective of the ecological receptor). Any quotient greater than or equal to 1 indicates that the ecological COPC warrants further evaluation to determine the actual likelihood of harm. COCs are selected only after an additional weight-of-evidence evaluation of the conservatism of the exposure assumptions, toxicity values, and uncertainties is conducted.

6.6.2.4.3 Measures of Ecosystem and Receptor Characteristics

Section 6.6.3.4 discusses the toxicity values associated with the COPCs. Endpoints stated in terms of specific ecological receptors or exposure classes (groups of species exposed by similar pathways) often require data on the processes that increase or decrease the exposure concentration below or above the measured or predicted environmental concentration. Thus, some quotients incorporate exposure factors (e.g., dietary soil fractions and bioaccumulation factors). Section 6.6.3.3 discusses exposure factors for the site.

6.6.3 Exposure Assessment

The exposure assessment evaluates potential exposure of ecological receptors to site-related constituents through evaluation of the following:

- Description of the spatial distribution of COPCs (Section 6.6.3.1)
- Description of spatial and temporal distribution of ecological receptors (Section 6.6.3.2)
- Quantification of exposure that may result from overlap of these distributions (Section 6.6.3.3).

6.6.3.1 Constituent Distribution

The extent of measured chemical contamination at the site is restricted to the areas sampled within and adjacent to SEAD-16. Site-related contamination of soil located beyond the immediate vicinity of the site has not been confirmed. The area of the site is approximately 2.8 acres. The ditches have a combined length of approximately 723 linear feet.

The magnitude of constituent exposures that may be experienced by ecological receptors is affected by the degree of their spatial and temporal associations with the site, as discussed in Sections 6.6.3.2 and 6.6.3.3.

6.6.3.2 Receptor Distribution

The approximately 2.8-acre study area was characterized in terms of ecological communities and receptors that could potentially be exposed to site-related contaminants. The site itself consists of the Terrestrial Cultural type of vegetation community with the site ditches classified as Ditch/Artificial Stream.

A variety of factors may affect the extent and significance of potential exposures. Receptor exposures are affected by the degree of spatial and temporal association with the site. For example, the receptors' mobility may significantly affect their potential exposures to site-related contaminants. Many species may only inhabit the study area during seasonal periods (e.g., breeding season, non-migratory periods). Non-migratory species may remain in the vicinity throughout the year. These species, particularly those with longer life spans (and usually larger home ranges), have the greatest potential duration of exposure. However, species with small home range sizes have the greatest potential frequency of exposure. Other factors affecting exposures include habitat preference, behavior (e.g., burrowing, rooting, foraging), individual home range size (larger home ranges correspond to far less frequent use of study area), and diet. Diet is of particular importance in exposure as related to (1) food source availability (larger amount of preferred food sources equals a greater potential for receptor usage) and (2) bioaccumulative contaminants. Contaminants that bioaccumulate may also tend to biomagnify in the food chain. This discussed in more detail in Section 6.6.3.3. As a result, predatory species at higher trophic levels may receive their most significant exposures through their prey. However, the possibility of a population of an upper trophic-level predator, or even an individual predator, utilizing the site as a primary source of food is considered extremely remote.

The deer mouse has a typical home range of approximately 0.15 acres (EPA, 1993). The SEAD-16 area of approximately 2.8 acres could constitute 100 percent of the home range of a deer mouse. The site drainage ditches, at approximately 723 linear feet, could provide 100 percent of the creek chub's home range.

6.6.3.3 Quantification of Exposure

Evaluation of the degree to which contaminant and receptor distributions (described in the previous two sections) coincide at the site indicated that the deer mouse is the receptor likely to have the greatest potential exposures to COPCs in soil and the creek chub to COPCs in surface water and sediment.

To quantify exposures of terrestrial receptors to each COPC, a daily intake of each constituent was calculated. Conversion of the environmental concentration of each COPC to an estimated daily intake for a receptor at the site was necessary prior to evaluation of potentially toxic effects. For terrestrial animal receptors, calculation of exposure intake rates relied upon determination of an organism's exposure to COPCs found in soil. Exposure rates for the deer mouse receptor were based upon ingestion of contaminants from this medium and also from consumption of other organisms. The ERA did not attempt to measure potential risk from dermal and/or inhalation exposure pathways given the insignificance of these pathways relative to the major exposure pathways (e.g., ingestion) and due to the scarcity of data available for these pathways.

The first step in measuring exposure rates for terrestrial wildlife was the calculation of food ingestion rates for the deer mouse receptor. The EPA's *Wildlife Exposure Factors Handbook* (EPA, 1993) includes a variety of exposure information for a number of avian, herptile, and mammalian species, including the deer mouse. Data are directly available for body weight, ingestion rate, and dietary composition for the deer mouse.

To provide conservative exposure rate calculations for the deer mouse, the mean body weight of 0.02 kg for the female deer mouse and the maximum food ingestion rate of 0.22 g/g-day (0.0044 kg/day) for a non-lactating mouse were used (EPA, 1993).

The *Wildlife Exposure Factors Handbook* (EPA, 1993) also presents average values for intake of animal matter and plant matter for the deer mouse as well as incidental soil ingestion. Soil ingestion has been measured at less than 2 percent of diet (Beyer et al., 1994). As might be expected based on the opportunistic habits of mice, the proportion of animal to plant matter in the diet varies from around 65 percent animal : 35 percent plant to 25 percent animal : 75 percent plant depending on season and region of the country. For this ERA, an approximate average of 50 percent animal : 50 percent plant was used, after subtracting the 2 percent for incidental soil ingestion. The dietary intakes calculated for this assessment are as follows:

Total Dietary Intake	=	0.0044 kg food/day
Plant Matter Intake	=	0.00216 kg plant matter/day
Animal Matter Intake	=	0.00216 kg animal matter/day
Incidental Soil Intake	=	0.000088 kg soil/day

A site-specific exposure dose of each COPC was calculated using a food chain uptake model consistent with EPA Region IV guidance (EPA, 1995). This algorithm accounts for exposure via incidental ingestion of contaminated soil, ingestion of plants grown in contaminated soil, and ingestion of lower trophic level animals associated with contamination. The exposure equation for soil is as follows:

$$ED_{soil} = [(C_s \times SP \times CF \times I_p) + (C_s \times BAF \times I_a) + (C_s \times I_s)] \times SFF / BW$$

where:

ED_{soil} = Soil exposure dose for terrestrial receptor (mg/kg/day)
C_s = RME concentration in soil (mg/kg)
SP = Soil-to-plant uptake factor (unitless)
CF = Plant wet-weight-to-dry-weight conversion factor (unitless) = 0.2 (used for SP values based on plant dry weight)
I_p = Receptor-specific ingestion rate of plant material (kg/day) = 0.00216 kg/day
BAF = Constituent-specific bioaccumulation factor (unitless)
I_a = Receptor-specific ingestion rate of animal material (kg/day) = 0.00216 kg/day
I_s = Receptor-specific ingestion rate of soil (kg/day) = 0.000088 kg/day
SFF = Site foraging factor (unitless) = 1 (see explanation below)
BW = Body weight (kg) = 0.02 kg

In evaluating the potential for a contaminant to pose ecological risk, it is important to consider its propensity for bioaccumulation even though its concentration in an environmental medium may be below toxic levels. Therefore, all COPCs were evaluated with regard to their ecological persistence and tendency to bioaccumulate.

Bioaccumulation is the process of absorption and retention of a substance by an organism due to both uptake from water (or other surrounding media) and uptake from ingested residues in food, soil, and/or sediment. It is quantified by the calculation of a bioaccumulation factor (BAF). Bioconcentration is a component of bioaccumulation, accounting only for the process of uptake from the surrounding medium (usually water). It is quantified by the calculation of a bioconcentration factor (BCF). Both BAFs and BCFs are proportionality constants relating the concentration of a contaminant in the tissues of an organism to the concentration in the surrounding environment (Amdur et al., 1991; EPA, 1989).

Bioaccumulation and bioconcentration may be a significant component of exposure to COPCs for the SEAD-16 receptors. For the deer mouse receptor, bioaccumulation was evaluated by means of contaminant-specific soil-to-plant uptake factors and BAFs. The soil-to-plant uptake factors were obtained from NRC (1992) for metals and for organic compounds by using a regression equation from Travis and Arms (1988). The latter is based on the contaminant-specific octanol/water partition coefficient (log K_{ow}). BAFs were obtained from the scientific literature. Factors reflecting accumulation of COPCs in earthworms were preferentially selected, based on the feeding habits of the deer mouse receptor. Tables 6-17 and 6-18 show values for soil-to-plant uptake factors and BAFs.

A site foraging factor (SFF) is calculated to account for the reasonably-expected use of an exposure group. Because of the small area of their home ranges and their year-round residence, mice and other small mammals living on the site could potentially use contaminated areas 100 percent of the time. The exposure dose calculations assumed the mouse would be exposed to the contaminants at the site in proportion to the size of the site (2.8 acres) compared to the typical size of an deer mouse foraging area (0.15 acre). Therefore, an SFF of 1 was used.

Tables 6-17 and 6-18 show the soil-to-plant uptake factors, bioaccumulation factors, and the calculation of daily intakes for soil and biota.

TABLE 6-17

CALCULATED SOIL RECEPTOR EXPOSURE
SURFACE SOIL

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Constituent	RME Concentration (mg/kg)	SP[1]		BAF[2]		Deer Mouse Exposure (mg/kg/day) [3]
Semivolatile Organics						
2,4-Dinitrotoluene	4.55E+00	2.67E+00	(4)	1.00E+00	(6)	1.82E+00
2,6-Dinitrotoluene	1.19E+00	3.21E+00	(4)	1.00E+00	(6)	5.47E-01
Acenaphthene	1.52E+00	2.10E-01	(4)	3.42E-01	(12)	9.73E-02
Benzo(a)anthracene	2.70E+00	1.97E-02	(4)	1.25E-01	(11)	5.41E-02
Benzo(b)fluoranthene	3.61E+00	8.88E-03	(4)	3.19E-01	(11)	1.44E-01
Benzo(ghi)perylene	2.29E+00	5.19E-03	(4)	2.44E-01	(11)	7.17E-02
Benzo(k)fluoranthene	2.31E+00	1.01E-02	(4)	2.53E-01	(11)	7.58E-02
Chrysene	2.97E+00	1.97E-02	(4)	1.75E-01	(11)	7.55E-02
Dibenzofuran	1.36E+00	1.72E-01	(4)	1.00E+00	(6)	1.78E-01
Dibenz(a,h)anthracene	1.52E+00	5.26E-03	(4)	3.68E-01	(11)	6.80E-02
Fluoranthene	3.84E+00	4.25E-02	(4)	7.92E-02	(11)	6.74E-02
Flourene	1.39E+00	1.43E-01	(4)	3.42E-01	(12)	7.89E-02
Indeno(1,2,3-cd)pyrene	2.38E+00	5.55E-03	(4)	4.19E-01	(11)	1.20E-01
Phenanthrene	2.98E+00	9.08E-02	(4)	1.22E-01	(11)	8.16E-02
Pyrene	3.92E+00	4.31E-02	(4)	9.20E-02	(11)	7.44E-02
Pesticides/PCBs						
Arochlor-1254	5.67E-02	9.00E-03	(10)	2.90E-01	(9)	2.08E-03
Arochlor-1260	6.24E-02	9.00E-03	(10)	2.90E-01	(9)	2.29E-03
Endrin ketone	4.54E-03	2.20E-02	(4)	2.50E-01	(9)	1.53E-04
Herbicides						
MCPP	4.33E+00	1.00E+00	(6)	1.00E+00	(6)	9.54E-01
Metals						
Antimony	4.77E+01	1.30E-04	(5)	1.00E+00	(6)	5.36E+00
Barium	4.11E+02	1.50E-01	(5)	1.00E+00	(6)	4.75E+01
Copper	5.85E+02	4.00E-01	(5)	3.69E-01	(7)	3.10E+01
Lead	6.21E+03	5.80E-03	(5)	6.82E-01	(8)	4.85E+02
Mercury	1.32E+00	9.00E-01	(5)	2.30E+01	(10)	3.31E+00
Selenium	6.63E-01	2.50E-02	(5)	4.70E-01	(13)	3.69E-02
Thallium	9.97E-01	2.70E-04	(5)	1.00E+00	(6)	1.12E-01
Zinc	4.01E+02	4.00E-03	(5)	1.00E+00	(6)	4.51E+01

(1) SP: soil-to-plant uptake factor.

(2) BAF: bioaccumulation factor.

(3) Deer mouse exposure calculated as

$ED = [(Cs * SP * CF * Ip) + (Cs * BAF * Ia) + (Cs * Is)] * UFF / BW$

Where, ED = exposure dose
Cs = RME conc in soil (mg/kg)
CF = plant dry-to-wet-weight conversion factor (0.2) (inorganics only)
SP = soil-to-plant uptake factor
Ip = plant-matter intake rate (0.00216 kg/day)
BAF = bioaccumulation factor (unitless)
Ia = animal-matter intake rate (0.00216 kg/day)
Is = incidental soil intake rate (0.000088 kg/day)
SFF = Site foraging factor (1)
BW = body weight (0.02 kg)

(4) Source: Travis and Arms, 1988.

(5) Source: NRC 1992.

(6) Default where no experimental data available, no evidence of bioaccumulation.

(7) Source: Ma et al., 1983. Cu BAF based on soil conc.

(8) Source: Ma et al., 1983. Pb BAF is based on soil conc., pH (=7.5), and % organic matter (=3.68%).

(9) Source: Menzie et al., 1992.

(10) Source: EPA, 1994c.

(11) Source: Marquerie et al., 1987, in Beyer, 1990.

(12) Used benzo(a)pyrene as surrogate.

(13) Source: Beyer and Cromartie, 1987. BAF based on highest level of earthworm uptake at industrial sites.

TABLE 6-18

CALCULATED SOIL RECEPTOR EXPOSURE
SUBSURFACE SOIL

SEAD-16 Remedial Investigation
Seneca Army Depot Activity

Constituent	RME Concentration (mg/kg)	SP[1]		BAF[2]		Deer Mouse Exposure (mg/kg/day) [3]
Semivolatile Organics						
2,4-Dinitrotoluene	3.80E+00	2.67E+00	(4)	1.00E+00	(6)	1.52E+00
2,6-Dinitrotoluene	4.25E-03	3.21E+00	(4)	1.00E+00	(6)	1.95E-03
Acenaphthene	1.33E+00	2.10E-01	(4)	3.42E-01	(12)	8.52E-02
Benzo(a)anthracene	2.46E+00	1.97E-02	(4)	1.25E-01	(11)	4.93E-02
Benzo(b)fluoranthene	3.38E+00	8.88E-03	(4)	3.19E-01	(11)	1.35E-01
Benzo(ghi)perylene	2.70E+00	5.19E-03	(4)	2.44E-01	(11)	8.45E-02
Benzo(k)fluoranthene	2.24E+00	1.01E-02	(4)	2.53E-01	(11)	7.35E-02
Chrysene	2.77E+00	1.97E-02	(4)	1.75E-01	(11)	7.04E-02
Dibenzofuran	1.17E+00	1.72E-01	(4)	1.00E+00	(6)	1.53E-01
Dibenz(a,h)anthracene	1.49E+00	5.26E-03	(4)	3.68E-01	(11)	6.66E-02
Fluoranthene	3.68E+00	4.25E-02	(4)	7.92E-02	(11)	6.46E-02
Flourene	1.22E+00	1.43E-01	(4)	3.42E-01	(12)	6.93E-02
Indeno(1,2,3-cd)pyrene	2.65E+00	5.55E-03	(4)	4.19E-01	(11)	1.33E-01
Phenanthrene	2.74E+00	9.08E-02	(4)	1.22E-01	(11)	7.50E-02
Pyrene	3.74E+00	4.31E-02	(4)	9.20E-02	(11)	7.10E-02
Pesticides/PCBs						
Arochlor-1254	6.00E-02	9.00E-03	(10)	2.90E-01	(9)	2.20E-03
Arochlor-1260	6.51E-02	9.00E-03	(10)	2.90E-01	(9)	2.39E-03
Endrin ketone	4.96E-03	2.20E-02	(4)	2.50E-01	(9)	1.68E-04
Herbicides						
MCPP	4.33E+00	1.00E+00	(6)	1.00E+00	(6)	9.54E-01
Metals						
Antimony	5.12E+01	1.30E-04	(5)	1.00E+00	(6)	5.76E+00
Barium	3.66E+02	1.50E-01	(5)	1.00E+00	(6)	4.23E+01
Copper	5.24E+02	4.00E-01	(5)	3.72E-01	(7)	2.79E+01
Lead	7.14E+03	5.80E-03	(5)	6.94E-01	(8)	5.68E+02
Mercury	1.27E+00	9.00E-01	(5)	2.30E+01	(10)	3.18E+00
Selenium	6.57E-01	2.50E-02	(5)	4.70E-01	(13)	3.66E-02
Thallium	1.32E+00	2.70E-04	(5)	1.00E+00	(6)	1.48E-01
Zinc	3.52E+02	4.00E-03	(5)	1.00E+00	(6)	3.96E+01

(1) SP: soil-to-plant uptake factor.

(2) BAF: bioaccumulation factor.

(3) Deer mouse exposure calculated as

ED = [(Cs * SP * CF * Ip) + (Cs * BAF * Ia) + (Cs * Is)] * UFF / BW

Where, ED = exposure dose

Cs = RME conc in soil (mg/kg)

CF = plant dry-to-wet-weight conversion factor (0.2) (inorganics only)

SP = soil-to-plant uptake factor

Ip = plant-matter intake rate (0.00216 kg/day)

BAF = bioaccumulation factor (unitless)

Ia = animal-matter intake rate (0.00216 kg/day)

Is = incidental soil intake rate (0.000088 kg/day)

SFF = Site foraging factor (1)

BW = body weight (0.02 kg)

(4) Source: Travis and Arms, 1988.

(5) Source: NRC 1992.

(6) Default where no experimental data available, no evidence of bioaccumulation.

(7) Source: Ma et al., 1983. Cu BAF based on soil conc.

(8) Source: Ma et al., 1983. Pb BAF is based on soil conc., pH (=7.5), and % organic matter (=3.68%).

(9) Source: Menzie et al., 1992.

(10) Source: EPA, 1994c.

(11) Source: Marquerie et al., 1987, in Beyer, 1990.

(12) Used benzo(a)pyrene as surrogate.

(13) Source: Beyer and Cromartie, 1987. BAF based on highest level of earthworm uptake at industrial sites.

For the aquatic receptor, the creek chub, intake rates were not calculated, as risk was characterized by comparing concentrations of contaminants in surface water and sediment with published toxicity concentrations in water and sediment. This is appropriate, as the toxicity values assume exposure by ingestion and absorption.

6.6.3.4 Effects Assessment

The effects assessment defines and evaluates the potential ecological response to ecological COPCs in terms of the selected assessment and measurement endpoints. The effects assessment includes the derivation of toxicity reference values (TRVs) that are the basis of the comparison. Section 6.6.4 uses the results of the toxicity assessment to identify ecological COCs and characterize ecological risk.

The methodology for assessing the potentially toxic effects of COPCs was based on the derivation of a TRV for each COPC in soil, surface water, and sediment. The TRVs were derived to represent reasonable estimates of the constituent concentrations that, if exceeded in an environmental medium, may produce toxicity effects in ecological receptors exposed to that medium. Ideally, TRV values would be based on site-specific toxicity data. However, in the absence of site-specific data, toxicity data from the literature were used by establishing data selection criteria such that TRVs would be as relevant as possible to assessment endpoints at SEAD-16. Furthermore, the conservativeness of the TRVs was reinforced by using the lowest available, appropriate toxicity values and modifying them by uncertainty factors when necessary. The derivation of TRVs is shown in Tables 6-19 for soil, 6-20 for surface water, and 6-21 for sediment.

The toxicity benchmarks used as effects thresholds for the evaluation of the assessment endpoint (maintenance of healthy populations of small mammals and fish) are based on LOAELs for test organisms (Sample et al., 1996). These are predicted to translate into less than 20 percent reduction in population size (Suter et al., 1994) or Lowest Observed Effects Concentrations. LOAELs are appropriate for evaluating the risk to non-threatened and endangered receptor populations (Suter et al., 1994).

For the terrestrial receptor, the order of taxonomic preference when choosing TRVs was data from studies using (1) native small mammal species potentially present at the site, or (2) proxy species, such as commonly studied laboratory species. The preferred toxicity test endpoint was

8/04/98

TABLE 6-19

TOXICITY REFERENCE VALUES FOR ECOLOGICAL COPCs SURFACE AND SUBSURFACE SOIL

SEAD-16 Remedial Investigation
Seneca Army Depot

Constituent	Test Organism	Endpoint/Duration/Effect	Source	Effect Dose (mg/kg/day)	Surrogate Chemical UF[1]	Endpoint UF[1]	Study Duration UF[1]	Inter-taxon UF[1]	Total UF[1]	Toxicity Reference Value[2] (mg/kg/day)
Semivolatile Organics										
2,4-Dinitrotoluene	rat	LOAEL, diet, 2-yr, changes in seminiferous tubules	EPA (IRIS) 1996b	3.40E+01	1	1	1	5	5	6.80E+00
2,6-Dinitrotoluene	rat	Used 2,4-dinitrotoluene as surrogate		3.40E+01	10	1	1	5	50	6.80E-01
Acenaphthene	mouse	LOAEL, gavage (oil), 13-wk, repro, hepatic effects	ATSDR 1995c	1.75E+02	1	1	5	5	25	7.00E+00
Benzo(a)anthracene	mouse	LOAEL, gavage, gestation day 7-16, repro effects	ATSDR 1995c	1.60E+02	10	1	1	5	50	3.20E+00
Benzo(b)fluoranthene	mouse	See benzo(a)anthracene		1.60E+02	10	1	1	5	50	3.20E+00
Benzo(ghi)perylene	mouse	See benzo(a)anthracene		1.60E+02	10	1	1	5	50	3.20E+00
Benzo(k)fluoranthene	moue	See benzo(a)anthracene		1.60E+02	10	1	1	5	50	3.20E+00
Chrysene	mouse	See benzo(a)anthracene		1.60E+02	10	1	1	5	50	3.20E+00
Dibenzofuran		No data available								none avail
Dibenz(a,h)anthracene	mouse	See benzo(a)anthracene		1.60E+02	10	1	1	5	50	3.20E+00
Fluoranthene	mouse	LOAEL, gavage (oil), 13-wk, incr liver weight	ATSDR 1995c	1.25E+02	1	1	1	5	5	2.50E+01
Flourene	mouse	LOAEL, gavage (oil), 13-wk, incr liver weight	ATSDR 1995c	1.25E+02	1	1	1	5	5	2.50E+01
Indeno(1,2,3-cd)pyrene	mouse	See benzo(a)anthracene		1.60E+02	10	1	1	5	50	3.20E+00
Phenanthrene	mouse	See benzo(a)anthracene		1.60E+02	10	1	1	5	50	3.20E+00
Pyrene	mouse	See benzo(a)anthracene		1.60E+02	10	1	1	5	50	3.20E+00
Pesticides										
Arochlor-1254	oldfield	LOAEL, diet, 12-mo, reproductive effects	Sample et al. 1996	6.80E-01	1	1	1	5	5	1.36E-01
Arochlor-1260	oldfield	Used Arochlor-1254 as surrogate		6.80E-01	10	1	1	5	50	1.36E-02
Endrin ketone	mouse	LOAEL, diet, 120-day, reproduction (Endrin)	Sample et al 1996	9.20E-01	10	1	1	5	50	1.84E-02
Herbicides										
MCPP	rat	LOAEL, diet, 90-day, increased kidney weight	EPA (IRIS) 1996b	9.00E+00	1	1	5	5	25	3.60E-01
Metals										
Antimony	mouse	LOAEL, water, lifetime, reduced lifespan	Sample et al 1996	1.25E+00	1	1	1	5	5	2.50E-01
Barium	rat	LOAEL, water, 10 days, mortality	Sample et al 1996	1.98E+02	1	3	10	5	150	1.32E+00
Copper	mouse	LOAEL, diet, 13-wk, gastrointestinal effects	ATSDR 1990d	1.55E+02	1	1	5	5	25	6.20E+00
Lead	rat	LOAEL, oral, 3 generations, reproductive effects	Sample et al 1996	8.00E+01	1	1	1	5	5	1.60E+01
Mercury	rat	LOAEL, diet, 3 generations, reproductive effects	Sample et al 1996	1.60E-01	1	1	1	5	5	3.20E-02
Selenium	mouse	LOAEL, water, 3 generations, reproductive effects	Sample et al 1996	7.50E-01	1	1	1	5	5	1.50E-01
Thallium	rat	LOAEL, water, 60-day, reproductive effects	ATSDR 1990f	7.40E-01	1	1	5	5	25	2.96E-02
Zinc	rat	LOAEL, oral, days 1-16 of gestation, reproduction	Sample et al 1996	3.20E+02	1	1	1	5	5	6.40E+01

[1] UF = uncertainty factor. Uncertainty factors are based on an EPA Region VIII method as described in Section 6.6.3.4.

[2] The toxicity reference value was derived by dividing the effect dose by the total uncertainty factor.

TABLE 6-20

TOXICITY REFERENCE VALUES FOR ECOLOGICAL COPCs
SURFACE WATER

SEAD-16 Remedial Investigation
Seneca Army Depot

Constituent	Endpoint	Source	Surrogate UF[1]	Toxicity Reference Value[2] (ug/L)
Semivolatile Organics				
Pentachlorophenol	NYS Ambient Water Quality Std	NYSDEC, 1993a	1	4.00E-01
bis(2-Ethylhexyl)phthalate	Lowest EC20, fish	Suter & Tsao, 1996	1	5.40E+01
Metals				
Aluminum	Lowest EC20, fish	Suter & Tsao, 1996	1	4.70E+03
Barium	EC16, Daphnia magna	Suter & Tsao, 1996	1	5.80E+03
Cadmium	Lowest EC20, fish	Suter & Tsao, 1996	1	1.80E+00
Cobalt	Lowest EC20, fish	Suter & Tsao, 1996	1	8.10E+02
Iron	Lowest EC20, daphnids	Suter & Tsao, 1996	1	1.60E+01
Lead	Lowest EC20, fish	Suter & Tsao, 1996	1	2.20E+01
Manganese	Lowest EC20, fish	Suter & Tsao, 1996	1	1.27E+03
Mercury	Lowest EC20, fish	Suter & Tsao, 1996	1	3.00E-02
Selenium	Lowest EC20, fish	Suter & Tsao, 1996	1	4.00E+01
Silver	Lowest EC20, fish	Suter & Tsao, 1996	1	2.00E-01
Zinc	Lowest EC20, fish	Suter & Tsao, 1996	1	4.70E+01

[1] UF = uncertainty factor.

[2] The toxicity reference value was derived by dividing the reported concentration by the surrogate uncertainty factor.

TABLE 6-21

TOXICITY REFERENCE VALUES FOR ECOLOGICAL COPCs
SEDIMENT

SEAD-16 Remedial Investigation
Seneca Army Depot

Constituent	Endpoint	Source	Surrogate UF	Toxicity Reference Value[2] (mg/kg)
Volatile Organics				
2-Butanone	Lowest chronic value, fish	Jones et al., 1996	1	2.00E+01
Acetone	Lowest chronic value, fish	Jones et al., 1996	1	1.08E+01
Semivolatile Organics				
2,4-Dinitrotoluene	No data available			none avail
Benzo(a)anthracene	Lowest chronic value, daphnids	Jones et al., 1996	1	9.57E+00
Benzo(a)pyrene	Lowest chronic value, daphnids	Jones et al., 1996	1	1.12E+01
Benzo(b)fluoranthene	Used benzo(a)pyrene as surrogate		10	1.12E+00
Benzo(ghi)perylene	Used benzo(a)pyrene as surrogate		10	1.12E+00
Benzo(k)fluoranthene	Used benzo(a)pyrene as surrogate		10	1.12E+00
Carbazole	No data available			none avail
Chrysene	Used benzo(a)pyrene as surrogate		10	1.12E+00
Indeno(1,2,3-cd)pyrene	Used benzo(a)pyrene as surrogate		10	1.12E+00
N-nitrosodiphenylamine	No data available			none avail
Pyrene	Used benzo(a)pyrene as surrogate		10	1.12E+00
Pesticides				
4,4'-DDD	Lowest chronic value, fish	Jones et al., 1996	1	6.17E+01
4,4'-DDE	Lowest chronic value, fish (DDD)	Jones et al., 1996	10	6.17E+00
4,4'-DDT	Lowest chronic value, fish	Jones et al., 1996	1	7.04E+01
Endosulfan I	Benthic aquatic life chronic toxicity	NYSDEC, 1993b	1	1.10E-03
Endosulfan II	Benthic aquatic life chronic toxicity	NYSDEC, 1993b	1	1.10E-03
Endosulfan sulfate	Benthic aquatic life chronic toxicity	NYSDEC, 1993b	1	1.10E-03
alpha-Chlordane	Lowest chronic value, fish	Jones et al., 1996	1	9.59E+01
gamma-Chlordane	Lowest chronic value, fish	Jones et al., 1996	1	9.59E+01
Metals				
Aluminum	No data available			none avail
Antimony	Lowest effect level	NYSDEC, 1993b	1	2.00E+00
Arsenic	Lowest effect level	NYSDEC, 1993b	1	6.00E+00
Barium	No data available			none avail
Beryllium	No data available			none avail
Cadmium	Lowest effect level	NYSDEC, 1993b	1	6.00E-01
Chromium	Lowest effect level	NYSDEC, 1993b	1	2.60E+01
Cobalt	No data available			none avail
Copper	Lowest effect level	NYSDEC, 1993b	1	1.60E+01
Iron	Lowest effect level	NYSDEC, 1993b	1	2.00E+04
Lead	Lowest effect level	NYSDEC, 1993b	1	3.10E+01
Mercury	Lowest effect level	NYSDEC, 1993b	1	1.50E-01
Nickel	Lowest effect level	NYSDEC, 1993b	1	1.60E+01
Selenium	No data available			none avail
Thallium	No data available			none avail
Vanadium	No data available			none avail
Zinc	Lowest effect level	NYSDEC, 1993b	1	1.20E+02

[1] UF = uncertainty factor. Uncertainty factors are based on an EPA Region VIII method as described in Section 6.6.3.4.

[2] The toxicity reference value was derived by dividing the effect dose by the total uncertainty factor. TRVs taken from Jones et al. (1996) are based on % organic carbon for SEAD-16 sediment samples (=3.65%).

the lowest appropriate chronic LOAEL for non-lethal or reproductive effects. LOAELs are appropriate for evaluating the risk to non-threatened/endangered receptor populations (Suter et al., 1994). When values were not available for these effects, LOAELs for lethal toxic effects were used, as available. Values based on chronic studies were preferred. Studies were considered to provide chronic toxicity data if conducted for a minimum duration of 1 year in mammals. Studies longer than acute but shorter than chronic are considered subchronic. Studies shorter than 90 days in mammals were considered acute. Studies on developmental effects were considered chronic if conducted during a critical gestation period.

The toxicity values selected by this approach were modified through the application of uncertainty factors, as applicable, to derive a TRV for each COPC. The TRVs represent LOAELs with uncertainty factors incorporated for toxicity information derived from studies other than chronic lowest-effects studies and studies on species other than the receptors selected for this risk assessment. EPA Region VIII (EPA, 1994a) has identified major areas where receptors differ in response to constituent exposure, as follows: type of study endpoint (e.g., chronic LOAEL versus acute LD_{50}), study duration (acute versus chronic), and species used for toxicity test. Each of these areas is then assigned an uncertainty factor from 1 to 20 based on the inherent variance. In addition, where toxicity information for a surrogate contaminant was used, an additional uncertainty factor of 10 was applied. Uncertainty factors were applied by dividing the initial toxicity value by the product of the necessary uncertainty factors. Uncertainty factors are listed in Table 6-22 and applied to TRVs in Table 6-19 for soil COPCs.

For surface water, the lowest concentration having an adverse effect on 20 percent of the test fish population (EC_{20}), as reported by Suter and Tsao (1996), was selected as the TRV. This represents a LOAEL-type endpoint for a fish population. Where no fish toxicity levels were reported, the lowest chronic aquatic invertebrate toxicity test result, as reported by Suter and Tsao (1996), was used for comparison purposes.

For sediment, the exposure point concentrations (RMEs) of organic COPCs were compared to lowest chronic toxicity values for fish, as developed by Jones et al. (1996) using an equilibrium partitioning approach. This approach assumes that pore water concentrations of organics are representative of concentrations to which receptors would be exposed, and pore water concentrations are calculated from sediment concentrations using equilibrium partitioning based on octanol/water partitioning coefficients and the organic carbon content of the sediment.

TABLE 6-22

ECOLOGICAL UNCERTAINTY FACTORS USED IN DERIVATION OF TRVs

SEAD-16 Remedial Investigation
Seneca Army Depot

Category of Uncertainty	Uncertainty Value[1]	
Surrogate constituent		
Use of surrogate constituent	10	
Intertaxon Extrapolation		
Same species	1	
Same genus, different species	3	
Same family, different genus	5	
Same order, different family	7	
Same class, different order	10	
Study Duration Extrapolation		
Chronic studies, equilibrium attained	1	
Subchronic studies	5	
Acute studies	10	
Single dose	20	
Unknown	20	
Endpoint Extrapolation	**Nonlethal**	**Lethal**
No observed effects level	1	1
No observed advese effects level	1	1
Lowest observed effects level	1	3
Lowest observed adverse effects level	1	3
Effect concentration to 50% of test organisms	10	15
Unknown	10	15

Source: EPA. 1994a.

[1] The product of the appropriate uncertainty value from each uncertainty category becomes the uncertainty factor applied to develop the constituent-specific TRV.

Partitioning of metals from sediment to pore water is dependent on a number of factors. Without additional information, pore water concentrations of the metals in the SEAD-16 ditches cannot be calculated. Consequently, the sediment RME concentrations were compared directly to the NYSDEC (1993b) screening criteria.

6.6.4 Risk Characterization

Risk characterization integrates exposure(s) and effect(s) on receptors using hazard quotients (HQs) (ratios of exposure and effect concentrations). The resulting data are used to define the magnitude of risk from ecological COPCs at the site and to assess the risk to ecological receptors. Risk characterization includes two main steps: risk estimation and risk description. Risk estimation (Section 6.6.4.1) uses the results of the exposure and effects assessments to calculate an HQ for each COPC. The HQs are based on relevant measurement endpoints and are indicative of the COPC's potential to pose ecological risk to receptors. Risk assessment related uncertainties are also analyzed and discussed. Risk description (Section 6.6.4.2) summarizes the conclusions of the risk estimation and discusses confidence in the risk estimates based on a weight-of-evidence evaluation. Any COPCs for a given exposure group and medium that were identified as likely to pose significant risk to receptors were classified as ecological chemicals of concern (COCs).

6.6.4.1 Risk Estimation

Estimation of a COPC's potential to pose significant risk to receptors is based on the magnitude of the HQ value calculated for each constituent, as well as other factors such as the bioaccumulation/biomagnification potential, mechanism of toxicity, physicochemical characteristics, environmental fate, and ecological relevance of each contaminant. Tables 6-23 through 6-26 present the calculation of HQs for COPCs. An HQ is a ratio of the estimated exposure dose (for terrestrial receptors) or concentration (for aquatic receptors) of a constituent to the TRV. Generally, the greater this ratio or quotient, the greater the likelihood of an effect. A quotient of 1 is considered the threshold level at which effects may occur. The TRVs on which the HQs were based were derived to be conservative and representative of chronic exposures, as described previously in Section 6.6.3.4.

The calculated HQs were used to assess the potential that toxicological effects will occur among the site's receptors. The HQs were compared to HQ guidelines for assessing the risk posed from

TABLE 6-23

CALCULATION OF SOIL HAZARD QUOTIENTS
SURFACE SOIL

SEAD-16 Remedial Investigation
Seneca Army Depot

Constituent	Deer Mouse Exposure (mg/kg/day)[1]	Toxicity Reference Value (mg/kg/day)[2]	Hazard Quotient[3]
Semivolatile Organics			
2,4-Dinitrotoluene	1.82E+00	6.80E+00	2.7E-01
2,6-Dinitrotoluene	5.47E-01	6.80E-01	8.0E-01
Acenaphthene	9.73E-02	7.00E+00	1.4E-02
Benzo(a)anthracene	5.41E-02	3.20E+00	1.7E-02
Benzo(b)fluoranthene	1.44E-01	3.20E+00	4.5E-02
Benzo(ghi)perylene	7.17E-02	3.20E+00	2.2E-02
Benzo(k)fluoranthene	7.58E-02	3.20E+00	2.4E-02
Chrysene	7.55E-02	3.20E+00	2.4E-02
Dibenzofuran	1.78E-01	none avail	--
Dibenz(a,h)anthracene	6.80E-02	3.20E+00	2.1E-02
Fluoranthene	6.74E-02	2.50E+01	2.7E-03
Flourene	7.89E-02	2.50E+01	3.2E-03
Indeno(1,2,3-cd)pyrene	1.20E-01	3.20E+00	3.7E-02
Phenanthrene	8.16E-02	3.20E+00	2.5E-02
Pyrene	7.44E-02	3.20E+00	2.3E-02
Pesticides			
Arochlor-1254	2.08E-03	1.36E-01	1.5E-02
Arochlor-1260	2.29E-03	1.36E-02	1.7E-01
Endrin ketone	1.53E-04	1.84E-02	8.3E-03
Herbicides			
MCPP	9.54E-01	3.60E-01	**2.7E+00**
Metals			
Antimony	5.36E+00	2.50E-01	**2.1E+01**
Barium	4.75E+01	1.32E+00	**3.6E+01**
Copper	3.10E+01	6.20E+00	**5.0E+00**
Lead	4.85E+02	1.60E+01	**3.0E+01**
Mercury	3.31E+00	3.20E-02	**1.0E+02**
Selenium	3.69E-02	1.50E-01	2.5E-01
Thallium	1.12E-01	2.96E-02	**3.8E+00**
Zinc	4.51E+01	6.40E+01	7.0E-01

(1) Receptor exposure from Table 6-17.
(2) Toxicity reference value from Table 6-19.
(3) Hazard quotient calculated as HQ = exposure rate / toxicity reference value
with HQ < 1, no effects expected
1 < HQ =< 10, small potential for effects
10 < HQ =< 100, potential for greater exposure to result in effects, and
HQ > 100, highest potential for effects.
BOLD : represents receptor HQ >= 1.
-- : no HQ could be calculated, as no toxicity data could be found.

TABLE 6-24

CALCULATION OF SURFACE WATER HAZARD QUOTIENTS

SEAD-16 Remedial Investigation
Seneca Army Depot

Constituent	RME Concentration (ug/L)[1]	Toxicity Reference Value (ug/L)[2]	Hazard Quotient[3]
Semivolatile Organics			
Pentachlorophenol	4.00E+00	4.00E-01	**1.0E+01**
bis(2-Ethylhexyl)phthalate	3.00E+00	5.40E+01	5.6E-02
Metals			
Aluminum	1.40E+02	4.70E+03	3.0E-02
Barium	1.54E+02	5.80E+03	2.7E-02
Cadmium	1.39E+00	1.80E+00	7.7E-01
Cobalt	2.31E+00	8.10E+02	2.9E-03
Iron	3.65E+03	1.60E+01	**2.3E+02**
Lead	5.32E+02	2.20E+01	**2.4E+01**
Manganese	2.17E+02	1.27E+03	1.7E-01
Mercury	2.29E-01	3.00E-02	**7.6E+00**
Selenium	2.58E+00	4.00E+01	6.5E-02
Silver	1.70E+00	2.00E-01	**8.5E+00**
Zinc	2.50E+02	4.70E+01	**5.3E+00**

(1) RME concentration from Table 6-15.

(2) Toxicity reference value from Table 6-20.

(3) Hazard quotient calculated as HQ = exposure rate / toxicity reference value
with HQ < 1, no effects expected
1 < HQ =< 10, small potential for effects
10 < HQ =< 100, potential for greater exposure to result in effects, and
HQ > 100, highest potential for effects.

BOLD : represents receptor HQ >= 1.

TABLE 6-25

CALCULATION OF SEDIMENT HAZARD QUOTIENTS

SEAD-16 Remedial Investigation
Seneca Army Depot

Constituent	RME Concentration (mg/kg)[1]	Toxicity Reference Value (mg/kg)[2]	Hazard Quotient[3]
Volatile Organics			
2-Butanone	1.01E-02	2.00E+01	5.1E-04
Acetone	2.38E-02	1.08E+01	2.2E-03
Semivolatile Organics			
2,4-Dinitrotoluene	3.04E+00	none available	--
Benzo(a)anthracene	3.39E-01	9.57E+00	3.5E-02
Benzo(a)pyrene	3.81E-01	1.12E+01	3.4E-02
Benzo(b)fluoranthene	7.43E-01	1.12E+00	6.6E-01
Benzo(ghi)perylene	3.37E-01	1.12E+00	3.0E-01
Benzo(k)fluoranthene	4.43E-01	1.12E+00	4.0E-01
Carbazole	1.10E-01	none available	--
Chrysene	1.16E+00	1.12E+00	**1.0E+00**
Indeno(1,2,3-cd)pyrene	3.23E-01	1.12E+00	2.9E-01
N-nitrosodiphenylamine	3.81E-01	none available	--
Pyrene	6.60E-01	1.12E+00	5.9E-01
Pesticides			
4,4'-DDD	7.30E-01	6.17E+01	1.2E-02
4,4'-DDE	5.70E-01	6.17E+00	9.2E-02
4,4'-DDT	4.20E-01	7.04E+01	6.0E-03
Endosulfan I	2.59E-02	1.10E-03	**2.4E+01**
Endosulfan II	4.31E-03	1.10E-03	**3.9E+00**
Endosulfan sulfate	7.58E-03	1.10E-03	**6.9E+00**
alpha-Chlordane	8.44E-03	9.59E+01	8.8E-05
gamma-Chlordane	2.38E-03	9.59E+01	2.5E-05
Metals			
Aluminum	1.69E+04	none available	--
Antimony	5.03E+01	2.00E+00	**2.5E+01**
Arsenic	7.39E+00	6.00E+00	**1.2E+00**
Barium	2.53E+03	none available	--
Beryllium	6.95E-01	none available	--
Cadmium	4.55E+00	6.00E-01	**7.6E+00**
Chromium	3.39E+01	2.60E+01	**1.3E+00**
Cobalt	1.18E+01	none available	--
Copper	1.40E+04	1.60E+01	**8.8E+02**
Iron	3.38E+04	2.00E+04	**1.7E+00**
Lead	2.22E+03	3.10E+01	**7.2E+01**
Mercury	2.50E+00	1.50E-01	**1.7E+01**
Nickel	4.04E+01	1.60E+01	**2.5E+00**
Selenium	1.98E+00	none available	--
Thallium	9.31E-01	none available	--
Vanadium	3.14E+01	none available	--
Zinc	5.02E+02	1.20E+02	**4.2E+00**

(1) RME concentration from Table 6-15.

(2) Toxicity reference value from Table 6-21.

(3) Hazard quotient calculated as HQ = exposure rate / toxicity reference value
with HQ < 1, no effects expected
1 < HQ =< 10, small potential for effects
10 < HQ =< 100, potential for greater exposure to result in effects, and
HQ > 100, highest potential for effects.

BOLD : represents receptor HQ >= 1.

-- : no HQ could be calculated, as no toxicity data could be found.

TABLE 6-26

CALCULATION OF SOIL HAZARD QUOTIENTS
SUBSURFACE SOIL

SEAD-16 Remedial Investigation
Seneca Army Depot

Constituent	Deer Mouse Exposure (mg/kg/day) [1]	Toxicity Reference Value (mg/kg/day) [2]	Hazard Quotient [3]
Semivolatile Organics			
2,4-Dinitrotoluene	1.52E+00	6.80E+00	2.2E-01
2,6-Dinitrotoluene	1.95E-03	6.80E-01	2.9E-03
Acenaphthene	8.52E-02	7.00E+00	1.2E-02
Benzo(a)anthracene	4.93E-02	3.20E+00	1.5E-02
Benzo(b)fluoranthene	1.35E-01	3.20E+00	4.2E-02
Benzo(ghi)perylene	8.45E-02	3.20E+00	2.6E-02
Benzo(k)fluoranthene	7.35E-02	3.20E+00	2.3E-02
Chrysene	7.04E-02	3.20E+00	2.2E-02
Dibenzofuran	1.53E-01	no data	--
Dibenz(a,h)anthracene	6.66E-02	3.20E+00	2.1E-02
Fluoranthene	6.46E-02	2.50E+01	2.6E-03
Flourene	6.93E-02	2.50E+01	2.8E-03
Indeno(1,2,3-cd)pyrene	1.33E-01	3.20E+00	4.2E-02
Phenanthrene	7.50E-02	3.20E+00	2.3E-02
Pyrene	7.10E-02	3.20E+00	2.2E-02
Pesticides			
Arochlor-1254	2.20E-03	1.36E-01	1.6E-02
Arochlor-1260	2.39E-03	1.36E-02	1.8E-01
Endrin ketone	1.68E-04	1.84E-02	9.1E-03
Herbicides			
MCPP	9.54E-01	3.60E-01	**2.7E+00**
Metals			
Antimony	5.76E+00	2.50E-01	**2.3E+01**
Barium	4.23E+01	1.32E+00	**3.2E+01**
Copper	2.79E+01	6.20E+00	**4.5E+00**
Lead	5.68E+02	1.60E+01	**3.5E+01**
Mercury	3.18E+00	3.20E-02	**1.0E+02**
Selenium	3.66E-02	1.50E-01	2.4E-01
Thallium	1.48E-01	2.96E-02	**5.0E+00**
Zinc	3.96E+01	6.40E+01	6.2E-01

(1) Receptor exposure from Table 6-18.
(2) Toxicity reference value from Table 6-19.
(3) Hazard quotient calculated as HQ = exposure rate / toxicity reference value
with HQ < 1, no effects expected
1 < HQ =< 10, small potential for effects
10 < HQ =< 100, potential for greater exposure to result in effects, and
HQ > 100, highest potential for effects.
BOLD : represents receptor HQ >= 1.
-- : no HQ could be calculated, as no toxicity data could be found.

contaminants (Menzie et al., 1993). These guidelines suggest that HQs less than or equal to 1 present no probable risk; HQs from 1 up to, but less than, 10 present a small potential for environmental effects; HQs from 10 up to, but less than 100 present a significant potential for ecological effects, and HQs greater than 100 present the highest potential for expected effects. The likelihood that a population of deer mice could be significantly impacted by the toxicological effect(s) produced by a given COPC was a major factor in the subsequent determination (in Section 6.6.4.2) of whether that contaminant should be classified as an ecological COC.

Ecological risk from COPCs was characterized for both current and potential future land use conditions at the site (Sections 6.6.4.1.1 and 6.6.4.1.2, respectively). Under current conditions, ecological receptors are unlikely to be exposed to soils deeper than 0.5 foot. Therefore, soil data from the surface down to this depth were used in characterizing current risk at SEAD-16. Under hypothetical future land uses involving construction, deeper (subsurface) soils could be excavated and distributed on the surface, where ecological receptors might then be exposed. Therefore, soil data from the surface down to a depth of 4 feet were used in characterizing risk associated with SEAD-16 under future conditions. Current and future conditions were assumed to be the same for the drainage ditches (surface water and sediment). Consequently, the drainage ditches are discussed only under current land use.

6.6.4.1.1 Current Land Use

Soil (0 - 0.5 ft)

For soil sampled to a depth of 0.5 ft at SEAD-16, HQs calculated for the COPCs equaled or exceeded a value of 1 for MCPP (HQ = 2.7), antimony (HQ = 21), barium (HQ = 36), copper (HQ = 5.0), lead (HQ = 30), mercury (HQ = 100), and thallium (HQ = 3.8) (Table 6-23). Dibenzofuran was carried through as a COPC because no toxicity data were available to calculate a TRV.

The HQ for MCPP (HQ = 2.7) exceeded 1. No data could be found to produce a soil-to-plant uptake factor or animal bioaccumulation factor for the deer mouse exposure to MCPP; therefore, values of 1 for each factor were used as default. It is unlikely that this chemical bioaccumulates, and a factor of 1 is likely to be an overestimate. For this reason, MCPP is not considered to be a COC in surface soil at this site.

The HQ for antimony (HQ = 21) exceeded 10. The TRV for antimony was based on a chronic study in which the median lifespan was reduced among female laboratory mice after exposure to antimony potassium tartrate in drinking water. This form of antimony tends to strongly adsorb to most soils (ATSDR, 1992b) and may not be highly bioavailable under natural conditions. However, lacking site-specific data, bioavailability was assumed to be 100 percent, which is likely to overestimate bioavailability. An animal bioaccumulation factor could not be found for antimony, but it does not appear to appreciably bioaccumulate (ATSDR, 1992b). Without more specific information, however, an animal bioaccumulation factor of 1 was used, which is likely to overestimate bioaccumulation. For these reasons, antimony is not considered to be a COC in surface soil at the site.

The HQ for barium (HQ = 36) was greater than 10. However, the toxicity benchmark value was based on an acute study in which barium was administered to rats in drinking water. When ingested by animals, soluble barium compounds are absorbed to a limited extent, while insoluble forms, such as barium sulfate and barium carbonate, are only minimally absorbed. Thus, soluble forms are highly toxic relative to insoluble forms (ATSDR, 1990b), and barium that has not leached from surficial soils at the site is likely to be in an insoluble form. Therefore, the study animals ingested soluble, more toxic forms of barium in water, while receptors at the unit would likely ingest insoluble, less toxic forms in soil. Based on these factors, barium in soil from this location was estimated to pose essentially no risk to assessment endpoints and is not considered to be a COC.

The HQ for copper (HQ = 5.0) exceeded 1. The TRV is based on a subacute (13-week) dietary study in which gastrointestinal effects were observed in mice. It is not known what result such effects, if experienced by the deer mice at the site, would have on the deer mouse population. Given the low HQ, copper is not considered to be a COC in surface soil at the site.

The HQ for lead (HQ = 30) exceeded 10. Oral exposure to lead leads to increases in blood pressure in laboratory animals (lead-induced hypertension) as well as interference with heme synthesis. Lead can also affect reproductive success in small mammals. A LOAEL resulting in reduced offspring weights and kidney damage in the young in a 3-generation reproductive test in laboratory rats was used to generate the TRV for this assessment (Sample et al. 1996). It is not known if such an effect would have an effect on the populations of small mammals at the site. In addition, the BAF for lead in earthworms is based on an equation in Ma et al., 1983, which accounts for bioavailability to some degree. Organic matter in soil tends to bind lead, and lead is less bioavailable at neutral or basic soil pH. Soil at the site has a moderate organic matter content (3.65%) and is slightly basic (pH=7.5). Therefore, given the HQ greater than 10 and the consideration of bioavailability in the exposure calculation, lead is considered a COC at this site.

Mercury has an HQ (HQ = 100) greater than 10. Mercury and its compounds have no known biological function. Mercury toxicity in aquatic and terrestrial organisms is well documented. The kidney as well as the central nervous system is the probable critical organ for toxicity effects from mercury in mammals. Mercury also causes teratogenic, mutagenic, and carcinogenic effects. Organic forms of mercury are capable of biomagnifying, especially in aquatic systems. In terrestrial food chains, little is known of mercury bioaccumulation. Carnivores at the top of the food chain appear to have elevated mercury concentrations, indicating biomagnification. The form(s) of mercury composing the total mercury concentration at the site is not known, so a conservative toxicity level from a chronic study on methyl mercury, an organic form of the metal, was used for the TRV (Sample et al. 1996). It is unlikely that all or most of the soil mercury is in the organic form, as organic mercury tends to be found more commonly in anaerobic sediments and the mercury in soil at this site has resulted from incineration, which should oxidize the metal. Inorganic forms of mercury are generally less toxic than organic forms. Nothing is known of the bioavailability of the mercury in soil at the site either. Absorption of inorganic mercury from oral exposure has been reported at 2 to 38 percent (ATSDR, 1994f). However, given the HQ considerably greater than 10, mercury in soil is considered a COC.

The HQ for thallium (HQ = 3.8) exceeded 1. While it appears that thallium may be completely absorbed from the gastrointestinal tract by animals consuming it in pure form, no information was available on bioavailability of thallium from a soil medium. The TRV is based on a subchronic study in which thallium was administered to rats in water. Likewise, no information was available on bioaccumulation of thallium in the terrestrial food chain, except for soil-to-plant uptake. Thallium does appear to bioaccumulate in an aquatic food chain. Given this uncertainty and the low HQ, thallium is not considered a COC for surface soil at this unit.

Dibenzofuran lacked data by which to evaluate its toxicity. Bioconcentration studies have shown that dibenzofuran can bioaccumulate significantly in aquatic organisms, but that depuration is rapid (HSDB, 1994). Therefore, long-term bioaccumulative effects and biomagnification are unlikely, and this compound is estimated to pose minimal ecological risk and is not considered to be a COC.

The PAHs have similar toxicological effects and target organs. While they are not equally toxic, a conservative assumption can be made that their effects are additive, and an HI can be calculated from the summed HQs for the PAHs. The HI for PAHs in surface soil is equal to 0.26. Most of the TRVs for the PAHs are based on a benzo(a)pyrene toxicity test with an uncertainty factor of 10 applied for use of a surrogate chemical. As benzo(a)pyrene is one of the most toxic of the PAHs, this uncertainty factor tends to overestimate risk. For this reason and with the low HI, PAHs are not considered to be COCs in surface soil.

Surface Water

Of the HQs calculated for the COPCs detected in surface water at SEAD-16, the HQs for pentachlorophenol (HQ = 10), iron (HQ = 230), lead (HQ = 24), mercury (HQ = 7.6), silver (HQ = 8.5), and zinc (HQ = 5.3) exceeded a value of 1 (Table 6-24).

Pentachlorophenol has an HQ equal to 10. This is based on a TRV of 0.4 ug/L, which is the New York Ambient Water Quality Standard. The toxicity of pentachlorophenol is dependent on the pH of the surface water. The federal Ambient Water Quality Criterion is calculated by an equation that includes a pH factor. Using this equation and the pH of the surface water in the SEAD-16 ditches (pH = 7.54), the federal Ambient Water Quality Criterion is 9.9 ug/L. This is greater than the RME concentration of pentachlorophenol in the surface water. For this reason, pentachlorophenol is not considered to be a COC in surface water.

The HQ for iron (HQ = 230) exceeded 100. The TRV used to calculate the HQ was based on an embryo-larval test with rainbow trout, a sensitive species that may not be representative of the fish species inhabiting the site ditches. The New York Ambient Water Quality Standard for iron for Class C water is 300 ug/L, at a hardness value of 188.18 mg/L CaCO3. This is less than the RME iron concentration of 3,650 ug/L. Given the HQ greater than 100 and the level of exceedence of the Ambient Water Quality Standard, iron is considered a COC in SEAD-16 surface water.

The HQ for lead (HQ = 24) is greater than 10. The RME concentration for lead in surface water, 425 ug/L, is over 50 times greater than the New York Ambient Water Quality Standard for lead for Class C water (considering hardness), which is 7.2 ug/L. Lead was detected in 13 of 13 surface water samples, and the RME concentration is the same as the maximum concentration.

Given the HQ greater than 10 and the level of exceedence of the Ambient Water Quality Standard, lead is considered a COC in SEAD-16 surface water.

The mercury HQ (HQ= 7.6) is greater than 1 but less than 10. The TRV used to calculate the HQ is based on an EC_{20} value of 0.03 ug/L for methyl mercury for brook trout. The form of mercury in the surface water in the site ditches is not known; however, it is unlikely to be entirely methyl mercury. Therefore, with an HQ less than 10, mercury is not considered to be a COC in the site surface water.

Silver has an HQ of 8.5 The TRV for silver is based on an EC_{20} value of 0.2 ug/L for rainbow trout, a sensitive species that may not be representative of the fish inhabiting the site ditches. The New York state ambient water quality standard for silver is 0.1 ug/L, which would result in an HQ greater than 10. Silver was only detected in 1 of 13 surface water samples. Further sampling would confirm the presence and reasonable maximum concentration of silver in the surface water. Based on this information, silver is not considered to be a COC in surface water.

The HQ for zinc (HQ = 5.3) is greater than 1 but less than 10. The New York state ambient water quality standard, based on hardness of the surface water at the site, is 140 ug/L. The TRV is based on an EC_{20} value of 47 ug/L. Neither produces an HQ greater than 10. For this reason, zinc is not considered to be a COC in surface water.

Sediment

Of the HQs calculated for the COPCs detected in sediment at SEAD-16, the HQs for chrysene (HQ = 1.0), endosulfan I (HQ = 24), endosulfan II (HQ = 3.9), endosulfan sulfate (HQ = 6.9), antimony (HQ = 25), arsenic (HQ = 1.2), cadmium (HQ = 7.6), chromium (HQ = 1.3), copper (HQ = 880), iron (HQ = 1.7), lead (HQ = 72), mercury (HQ = 17), nickel (HQ = 2.5), and zinc (HQ = 4.2) exceeded a value of 1 (Table 6-25). No toxicity values could be found for 2,4-dinitrotoluene, carbazole, n-nitrosodiphenylamine, aluminum, barium, beryllium, cobalt, selenium, thallium, and vanadium.

The concentrations of metals and the endosulfan compounds in sediment were compared to NYSDEC screening criteria, which do not account for bioavailability. The screening criteria also were developed with the assumption that the aquatic organisms would be exposed to the contaminants during the entire year. As flow is variable in the site ditches and they do not provide quality habitat, it is unlikely that the receptors are exposed all year. Additional testing would provide more information on bioavailability and toxicity of the site sediment. Without this information, it cannot be determined with confidence that the sediment is not causing adverse effects to assessment endpoints. However, even with the very conservative screening criteria that were used for TRVs, given the high HQs, the sediment in the SEAD-16 drainage ditches is considered to have a strong potential to cause adverse effects to aquatic organisms. HQs of three metals are greater than 10 (antimony, lead and mercury) and of one other metal (copper) greater than 100. In addition, the combined HQs of the three endosulfan compounds, endosulfan I, endosulfan II and endosulfan sulfate, equaled 35. For these reasons, endosulfan I, endosulfan II, and endosulfan sulfate; as well as antimony, copper, lead, and mercury are considered to be COCs in sediment at the site ditches. Further investigation of sediment toxicity and bioavailability of these COCs is recommended.

The HI for PAHs is equal to 3.4. For reasons discussed above for surface soil, PAHs are not considered to be COCs in sediment.

6.6.4.1.2 Future Land Use

Soil (0 - 4 ft)

Of the HQs calculated for the COPCs detected in soil to a depth of 4 ft at SEAD-16, the HQs for MCPP (HQ = 2.7), antimony (HQ = 23), barium (HQ = 32), copper (HQ = 4.5), lead (HQ = 35), mercury (HQ = 100), and thallium (HQ = 5.0) exceeded 1 (Table 6-26). Dibenzofuran was carried through as a COPC because no toxicity data were available to calculate a TRV.

As for the soil at a depth of 0 - 0.5 ft, lead and mercury are considered to be COCs at a depth of 0 - 4 ft.

As with the 0 - 0.5 ft soil, dibenzofuran was carried through as a COPC because toxicity data were not available to calculate a TRV. For reasons discussed under current soil conditions, this constituent is not considered to be a COC.

The HI for PAHs is equal to 0.25. For reasons discussed above for surface soil, PAHs are not considered to be COCs in soil at a depth of 0 - 4 ft.

6.6.4.2 Uncertainty

Uncertainty is inherent in each step of the ecological risk assessment process. Major factors contributing to uncertainty in this risk assessment are discussed qualitatively in the following sections.

6.6.4.2.1 Chemicals of Potential Concern

The sampling data may not represent the actual overall distribution of contamination at the site, which could result in underestimation or overestimation of potential risk from identified chemicals. However, the use of RME concentrations provided conservative exposure estimates and it is, therefore, unlikely that the potential for deleterious levels of contaminants has been underestimated.

6.6.4.2.2 Exposure Assessment

While the potential receptor species selected for the site are inevitably a limited subset of the total list of species that may utilize the site, the potential exposure of the species evaluated in this assessment is considered likely to be representative of the nature and magnitude of the exposures experienced by those species not discussed.

Risk associated with intake of contaminants through the terrestrial food chain was addressed by modeling food chain transfer of chemical residues through plants and earthworms. The degree of uncertainty in the results of the analysis increases with the increasing distance of the receptor from the base of the food chain. Intakes from dermal contact with and inhalation of contaminants were not quantifiable for ecological receptors. However, this does not significantly increase the uncertainty of the estimated intakes because for most receptors, intakes via these routes are likely to be minimal relative to intakes via ingestion.

Risk was estimated for both current land use and future land use conditions. Whereas estimates of the potential for risk to assessment endpoints under current conditions potentially could be underestimated because of data insufficiencies (although unlikely because of conservative assumptions), such estimates for hypothetical future conditions are more likely to overestimate the potential for adverse effects.

6.6.4.2.3 Toxicity Assessment

There is uncertainty associated with the TRVs calculated for this risk characterization because the toxicity data were not site-specific. However, the TRVs used were conservative and were modified by uncertainty factors where necessary to increase the applicability of the data to the assessment. The HQs calculated from these conservative TRVs and RME concentrations provide confidence that the risk assessment yielded reasonably conservative estimates of the potential risk of adverse ecological effects on the assessment endpoint.

Each COPC was assumed to be highly bioavailable. However, for most chemicals in most media, this is an overestimation (Dixon et al., 1993) that may result in an overestimation of the potential for ecological risk. Empirical information on bioavailability of the COPCs was not available. No leachability tests in soil or sediment were conducted. No analysis for acid-volatile sulfide/simultaneously extracted metals was conducted as a measure of bioavailability in sediment. It is possible that some of the contaminants, particularly the metals, may be bound to soil or sediment particles and not available for uptake by receptors. This would tend to overestimate risk.

The soil-to-plant uptake equations and the BAFs include a bioavailability factor; however, these data, taken from the scientific literature, are not specific to this site and may under- or overestimate exposure. For several metals, no quantitative bioavailability data could be found, other than an indication from the literature that the constituent does not significantly bioaccumulate. For these metals, a bioaccumulation factor of 1.0 was used in the exposure equation. This is likely to overestimate the actual value.

The potential for toxic effects to be produced in receptor organisms as a result of exposure to multiple chemicals in a single medium or in multiple media was not evaluated. Therefore, the potential toxic effects in a receptor as a result of exposure to a given medium could be higher or lower than estimated, depending on toxicological interactions. Exposure of a receptor to multiple contaminated media is likely to increase the risk of toxic effects.

6.6.4.2.4 Risk Characterization

The methodology, conservative assumptions, and toxicity benchmarks used in the risk estimation portion of the risk characterization are expected to overestimate, rather than underestimate, the potential for COPCs to pose risk to the ecological assessment endpoint. RME environmental concentrations were used, concentrations were assumed to remain constant over time, and the toxicity benchmarks used were the lowest reported LOAEL values for non-lethal or reproductive effects appropriate for extrapolation to effects on the assessment endpoint.

6.6.4.3 Risk Description

The risk description has two main elements: (1) the ecological risk summary, which summarizes the results of the risk estimation and uncertainty analysis and assesses confidence in the risk estimates based on weight of evidence and (2) the interpretation of ecological significance, which describes the magnitude of the identified risks to the assessment endpoint(s).

6.6.4.3.1 Ecological Risk Summary

The risk estimation step resulted in the identification of a subset of COPCs for each medium for both current and hypothetical future conditions. These subsets of COPCs include those contaminants estimated to have the potential to pose adverse effects to the assessment endpoints selected in Section 6.2.3. In the following section, these COPCs are further evaluated based on weight of evidence, and a determination is made as to whether any have a high likelihood of being a significant risk to the receptor population analyzed for this risk assessment or the ecological community that encompasses the study area.

A hierarchy of assessment endpoints was selected to assess both proximate and ultimate risks that might be associated with site-related chemicals. The proximate assessment endpoint was chosen to provide protection of the population levels of vertebrate species that utilize the area of SEAD-16 to a significant extent and that are important as indicators of potential effects on the health of the community. Deer mice represent terrestrial vertebrate populations at SEAD-16 and creek chub represent the aquatic community. Although toxic effects that reduce this assessment endpoint population or the populations they represent in the immediate vicinity of the site are significant to the populations themselves, they are not necessarily significant to the ultimate, more important, assessment endpoint: the community of species that occupies the area surrounding and including the site.

It is this ultimate assessment endpoint, maintenance of the health and diversity of the natural community in the area, that is the most important ecological component to be protected with regard to this site. Therefore, those COCs estimated to pose a potential for adverse effects to proximate assessment endpoints are subsequently evaluated with regard to the risk they may pose to the ultimate assessment endpoint.

The ecological setting of SEAD-16 is not unique or significant, as described in Section 6.6.2.2. There are no endangered, threatened, or special concern species in the vicinity that are likely to be dependent on or affected by the habitat at the site. The species that inhabit the site are not rare in the region and are not generally considered to be of special societal value. The area of the site is small, and the habitat it provides appears to be relatively low in diversity and productivity.

Seven of the COPCs identified in soil, six in surface water, and 15 in sediment at SEAD-16 have an HQ equal to or greater than 1. These are listed below according to the medium in which they occurred.

MEDIUM	COPC
SOIL	
current conditions	MCPP (HQ=2.7), antimony (HQ=21), barium (HQ=36), copper (HQ=5.0), lead (HQ=30), mercury (HQ=100), thallium (HQ = 3.8)
future conditions	MCPP (HQ=2.7), antimony (HQ=23), barium (HQ=32), copper (HQ=4.5), lead (HQ=35), mercury (HQ=100), thallium (HQ = 5.0)
SURFACE WATER	pentachlorophenol (HQ=10), iron (HQ=230), lead (HQ=24), mercury (HQ=7.6), silver (HQ=8.5), zinc (HQ=5.3)
SEDIMENT	chrysene (HQ=1.0), endosulfan I (HQ=24), endosulfan II (HQ=3.9), endosulfan sulfate (HQ=6.9), antimony (HQ=25), arsenic (HQ=1.2), cadmium (HQ=7.6), chromium (HQ=1.3), copper (HQ=880), iron (HQ=1.7),

lead (HQ=72), mercury (HQ=17), nickel (HQ=2.5), zinc (HQ=4.2)

There is a low likelihood of risk to the proximate terrestrial assessment endpoint (i.e., deer mouse populations at the site) from the concentrations of MCPP, antimony, barium, copper, and thallium in soils based on the following weight of evidence.

- The HQs for MCPP, copper, and thallium are less than 10. According to the guidelines originally proposed by Menzie et al. (1993), HQs from 1 up to, but less than, 10 present a small potential for environmental effects.
- Calculation of the TRVs and exposure rates for the constituents was a very conservative process. For barium, for example, a total uncertainty factor of 150 was used to equate the acute lethal LOAEL toxicity datum to a chronic non-lethal LOAEL.
- Nothing is known about the bioavailability of the constituents in soil at the site. They may be present in an insoluble form in the soil, which is not very bioavailable for uptake by receptors. Some constituents are likely to be tightly bound to organic matter in the soil and therefore not very bioavailable for uptake. The exposure assessment assumed 100 percent bioavailability from soil, which is likely to more conservatively estimate risk.
- Habitat quality of the site is poor. It is unlikely that the site provides an important habitat that would support a significant portion (at least 20 percent) of the deer mouse population in the local area.

Therefore, MCPP, antimony, barium, copper, and thallium in surface and subsurface soil are not considered to be COCs.

Lead and mercury in surface soil and subsurface soil are considered to be COCs. Both have HQs greater than 10. A factor for bioavailability, though not site specific, was incorporated into the deer mouse exposure equation for lead. With bioavailability accounted for in some degree, and an HQ greater than 10, lead is considered to be a COC. Mercury was assumed to be 100 percent bioavailable. The HQ for mercury was based on a TRV for methyl mercury, which is a more toxic form than inorganic mercury. While the form of mercury in soil at the site is not known, it is not likely to be in the organic form. Nevertheless, with an HQ considerably greater than 10, mercury is considered to be a COC.

The COPCs in surface water and sediment that have HQs greater than 1 but less than 10 are not likely to adversely impact populations of creek chub in the surface water bodies at the depot. The site ditches are not quality habitat and have variable flow throughout the course of a year. It is unlikely that the creek chub observed in the ditches make up 20 percent of the local population or even occupy the ditches on the site throughout the year. Those COPCs in surface water and sediment with HQs less than 10 are not considered to be COCs.

Iron and lead are considered to be COCs in surface water. Both have HQs greater than 10, and greatly exceed the New York Ambient Water Quality Standards.

Endosulfan I, endosulfan II, endosulfan sulfate, antimony, copper, lead, and mercury are considered to be COCs in sediment. The combined three endosulfan compounds and each of the four metals have HQs greater than 10, with copper greater than 100.

6.6.4.3.2 Interpretation of Ecological Significance

There is the potential for risk to the deer mouse and creek chub individuals that may use the site as a result of COC concentrations in soil, surface water, and sediment.

6.7 SUMMARY

The human health risk assessment was performed in accordance with the USEPA's Risk Assessment Guidance for Superfund (EPA,1989b). The human health risk assessment considered six potential exposure scenarios: a current site worker, a future industrial worker, a future construction worker, a future trespasser, and an adult worker and child at an on-site day care center. The results of the human health risk assessment show that only a future industrial worker or construction worker has the potential to be exposed to chemicals of concern at levels that are above those defined by the USEPA. The ecological risk assessment was performed following the guidance presented in the New York State *Division of Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites* (NYSDEC 1994), *the Framework for Ecological Risk Assessment* (EPA, 1992f), and the *Procedural Guidelines for Ecological Risk Assessment at U.S. Army Sites, Vol. 1* (Wentsel et al., 1994). The results of the ERA indicate that the COPCs identified at SEAD-16 are considered to pose a negligible risk to the ecosystem surrounding the site.

6.7.1 Human Health Risk Assessment

Human health risks were calculated for six exposure scenarios:

1) current on-site worker;
2) future industrial worker;
3) future on-site construction worker;
4) future trespasser;
5) future child attending an on-site day care center; and
6) future adult worker at the day care center

Of these six receptors, only the future industrial worker exhibits risks of cancer above the USEPA target risk range, in addition to non-cancer health risk. As shown in Table 6-8, the RME excess cancer risk of 5×10^{-3} and the hazard index of 20 are due primarily to ingestion of indoor dust. Dermal contact with indoor dust and ingestion of groundwater also pose non-cancer risks which result in a hazard index greater than 1. In evaluating this result, the likelihood of occupancy of building S-311 in its current state by a new industrial operation should be considered. If the building is renovated prior to occupancy, or if the industrial operation is in a new building, then the risks to future workers would be much lower than estimated in this assessment.

Three other receptors exhibit non-cancer hazard indices which exceed 1: the future construction worker, and the future day care center child and worker. For the construction worker, the combination of ingestion of soil and inhalation of dust during construction activities cause the RME hazard index to reach a value of 1. For both the child and worker at the day care center, ingestion of groundwater is the primary contributor to non-cancer risk. In addition, for the day care center child, ingestion of soil causes the hazard index to exceed 1.

Both the carcinogenic and non-cancer health risks for two receptors were within or below the USEPA target levels: the current site worker and the future trespasser.

The potential risks from exposure to lead in soil were assessed separately from other compounds. The results of the IEUBK model for lead indicates that ingestion of soil at SEAD 16 by children attending a future day care center has the potential to cause blood lead levels to exceed the 10 ug/dL level of concern established by EPA and other public health agencies. Furthermore, the current average soil lead levels exceed the USEPA guideline concentration of 1750 mg/kg for adult exposure.

6.7.2 Ecological Risk Summary

A hierarchy of assessment endpoints was selected to assess both proximate and ultimate risks that might be associated with site-related chemicals. Deer mice represent terrestrial vertebrate populations at SEAD-16 and creek chub represent the aquatic community. Compared to the proximate, the ultimate assessment endpoint maintenance of the health and diversity of the natural community in the area is the most important ecological component to be protected with regard to this site. Therefore, those COCs estimated to pose a potential for adverse effects to proximate assessment endpoints are subsequently evaluated with regard to the risk they may pose to the ultimate assessment endpoint.

The ecological setting of SEAD-16 is not unique or significant there are no endangered, threatened, or special concern species in the vicinity that are likely to be dependent on or affected by the habitat at the site. The species that inhabit the site are not rare in the region and are not generally considered to be of special societal value. The area of the site is small, and the habitat it provides appears to be relatively low in diversity and productivity.

Of the COPCs at SEAD-16 having an HQ equal to or greater than 1, seven were identified in soil, six in surface water, and 15 in sediment. In surface soil and subsurface soil, lead and mercury are considered to be COCs. Both have HQs greater than 10. In surface water, iron and lead are considered to be COCs. Both have HQs greater than 10, and greatly exceed the New York Ambient Water Quality Standards. In sediment, endosulfan I, endosulfan II, endosulfan sulfate, antimony, copper, lead, and mercury are considered to be COCs. The combined three endosulfan compounds and each of the four metals have HQs greater than 10, with copper greater than 100.

There is the potential for risk to the deer mouse and creek chub individuals that may use the site as a result of COCs concentrations in soil, surface water, and sediment.

7.0 BASELINE RISK ASSESSMENT INTRODUCTION

This section of the SEAD-16&17 Remedial Investigation report will present the baseline human health and ecological risk assessments that were performed for the Active Deactivation Furnace site (SEAD-17). The workplan for this risk assessment was included in the "Project Scoping Plan for the Remedial Investigation/Feasibility Study at SEAD-16 and 17" submitted to USEPA Region II in July 1995. The exposure scenarios that are evaluated in the baseline human health risk assessment (BRA) are:

- exposure of a current site worker to on-site contaminants
- exposure of a future industrial worker to on-site contaminants
- exposure of a future construction worker to on-site contaminants
- exposure of a future child trespasser to on-site contaminants
- exposure of a future worker and child at an on-site day care center to on-site contaminants

The ecological risk assessment performed for this site considers the exposure of all species currently know to frequent, or potentially frequent, SEAD-17. The ecological risk assessment also identifies the deer mouse as the ecological risk assessment endpoint, which is then used to evaluate the impacts to the local ecosystem that are caused by the current site conditions.

Included in the sections that follow are brief descriptions of the Active Deactivation Furnace's operating history and site characteristics, as well as full discussions on the identification of potential chemicals of concern, the screening of on-site inorganic element concentrations in soils, and determining reasonable and conservative exposure concentrations. Following these discussions, the report presents first the exposure scenarios that were defined for the human health BRA, followed by the human health risk calculations that quantify the carcinogenic and non-carcinogenic risk for the various exposure scenarios. The report then presents the ecological risk assessment that was performed for SEAD-17, which includes discussions on quantifying ecological exposure, determining ecological toxicity reference values, and calculating and evaluating ecological quotients.

7.1 OVERVIEW

The primary mandate of the Superfund program is to protect both human health and the environment from current and potential threats posed by uncontrolled hazardous substance releases. As part of the Remedial Investigation, the Active Deactivation Furnace (SEAD-17) was evaluated to assess potential risks to human health and the environment. The goal of this baseline risk assessment is to provide a framework for developing and presenting the necessary risk information to assist in remedial action decisions.

The objectives of the baseline risk assessment are: to help determine whether additional response actions are necessary at the site; to provide a basis for determining residual chemical levels that are adequately protective of human health and the environment; to provide a basis for comparing potential health impacts of various remedial alternatives; and to help support selection of the "No Action" remedial alternative, where appropriate. To meet these objectives, the *Risk Assessment Guidance for Superfund* (RAGS) (USEPA, 1989a) was followed when possible and applicable. However, as stated in the guidance document, "The Human Health Evaluation Manual (also referred to as RAGS) admittedly cannot address all site circumstances." Technical judgment, consultation with USEPA staff, and recent publications were therefore also used in the development of the baseline risk assessment.

The baseline risk assessment is divided into two basic components: the human health evaluation and the ecological risk assessment evaluation. As part of the human health BRA, separate risk calculations are presented for current and future onsite land-use scenarios. The ecological risk assessment presents risk calculations for current site conditions only.

7.1.1 Site Description

SEDA is an active military facility located near Romulus, New York. The facility is located in an uplands area, at an elevation of approximately 600 feet above Mean Sea Level (MSL), that forms a divide separating two of the New York Finger Lakes, Cayuga Lake on the east and Seneca Lake on the west. Sparsely populated farmland covers most of the surrounding area. New York State Highways 96 and 96A adjoin SEDA on its east and west boundaries, respectively.

The Active Deactivation Furnace (SEAD-17) is located in the east central portion of SEDA. The site consists of Building 367, two small sheds, an aboveground fuel oil tank, and their surrounding grounds. The Introduction (Section 1) and the Detailed Site Description (Section 3.1) portions of this report provide complete details on the site description.

7.1.2 General Site History

SEDA was constructed in 1941 and has been owned by the United States Government and operated by the Army since this time. Since its inception, SEDA's primary mission has been the receipt, storage, maintenance, and supply of military items. Prior to construction of the depot, the site was used for farming.

The Active Deactivation Furnace (SEAD-17) was in use from approximately 1962 to 1989. The Site History section of this report (Section 1.4.2) presents further information on this site's operating history.

7.1.3 General Sampling Locations and Media

During the RI and previous investigations, samples of soil, groundwater, surface water and sediment were collected. Soil samples were collected from random surface soil locations, biased surface soil locations where contaminants were likely to accumulate, and soil borings. Groundwater samples were collected from groundwater monitoring wells situated around Building 367 and two sheds in the northeast portion of the site. Surface water and sediment samples were collected from the drainage swales that surround the SEAD-17 site. Complete details of all sampling locations are provided in the Study Area Investigation portion of this report (Section 2).

Following the collection, validation and screening (of metals in soil data and groundwater data only) of these data, subsets of this collected data were utilized to establish the Exposure Point Concentrations (EPCs) for the various exposure scenarios used in the risk assessments. The selection of the data to be used to determine EPC values was based upon consideration of the sample media and the location and the depth of the sample, and is consistent with the identified exposure scenarios.

EPCs were determined for the following exposure routes for this risk assessment:

1. Ingestion and dermal contact with surface water and sediments while wading in the associated drainage swales.

2. Incidental ingestion and dermal contact to on-site soils (both surface and subsurface soils).

3. Inhalation of particulate matter in ambient air.

4. Ingestion and dermal contact with dust and debris inside the Active Deactivation Furnace building (Building 367).

All on-site surface water and sediment data collected from SEAD-17 were used to estimate the EPC for future trespasser scenarios only. Current land use scenarios applicable to surface water and sediment were not considered realistically plausible because of the unlikelihood that wading in the on-site drainage swales would occur in the current land use exposure scenario for the site worker. Exposure to surface water and sediment for the future industrial worker is considered unlikely. All on-site groundwater data collected from SEAD-17 were used to estimate the EPC for future land use scenarios only. Groundwater is not currently used, as drinking water at all of SEDA is delivered by pressure pipe from an off-site water supply.

All on-site surface soil samples from the 0 to 0.5 foot range were used in estimating the EPC due to on-site dermal exposure and soil ingestion for the current site worker, future industrial worker, future trespasser, and future day care scenarios. All surface and subsurface soil samples were combined and used in estimating the EPC for soil ingestion and dermal exposure for the future construction worker scenario.

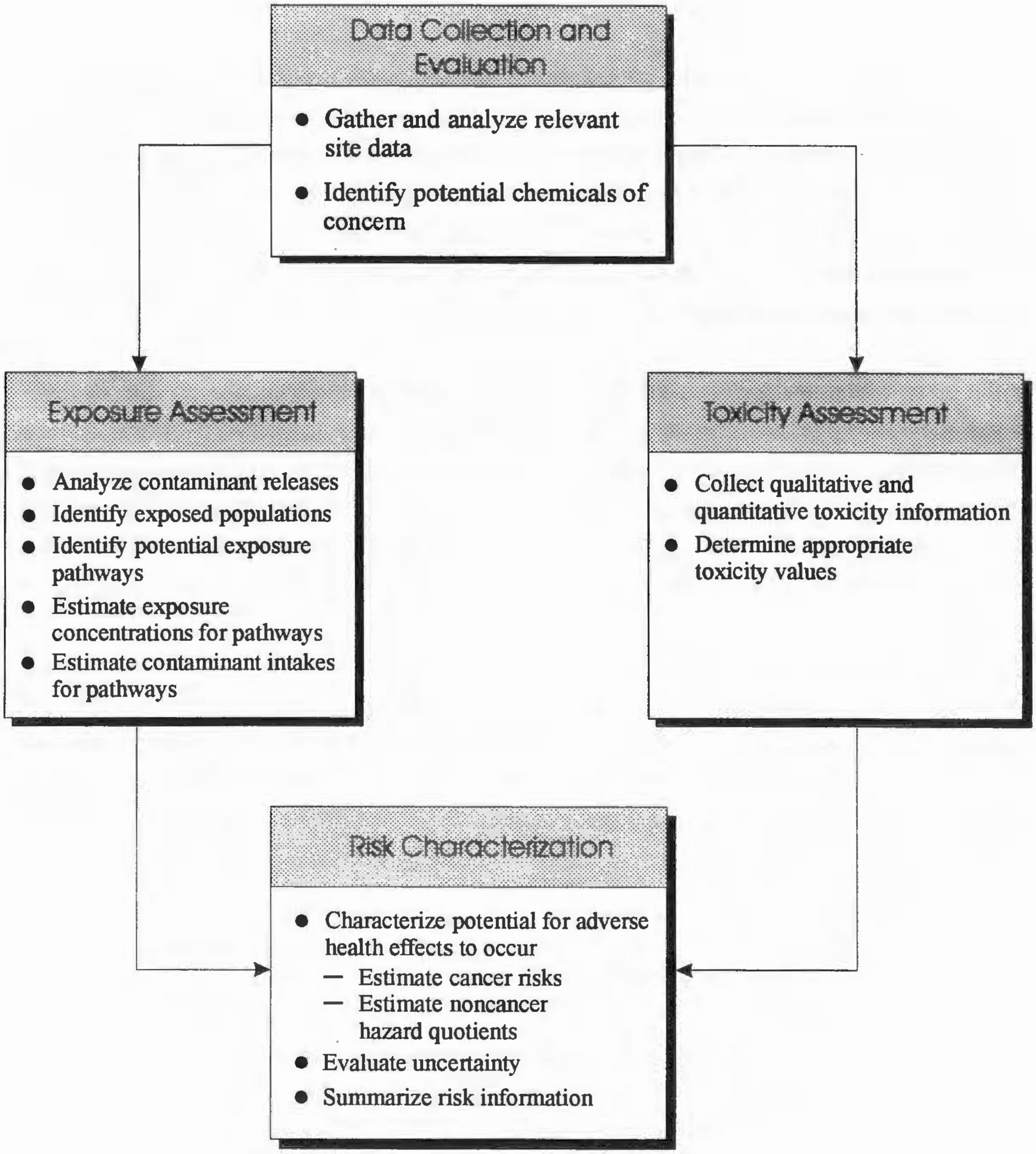
Each soil data set was again used as input to a model to estimate ambient air EPCs of compounds contained in airborne particulates derived from soil.

7.1.4 <u>Methodology and Organization of Document</u>

The methodology employed for this baseline risk assessment follows USEPA guidance. The relationships of the major steps involved are presented in flowchart form in Figure 7-1.
This section contains seven major subsections, as follows:

1. Identification of Chemicals of Concern (Section 7.2)

This section provides site-related data along with background chemical data. Detailed summaries and statistical analyses of these data are provided in this section. All chemicals with validated detections in the applicable environmental media were evaluated in the risk assessment. The relevant exposure pathway risks were calculated for each detected chemical. Also included in the Data Evaluation section is an evaluation of site background data. Relevant background data are presented and, where appropriate, statistical analyses (e.g. Wilcoxon Rank Sum Test) were performed to allow for comparing on-site chemical concentrations with available background data to drop any data which is not applicable to the baseline risk assessment. The process is further defined in more detail in section 7.2.2.



Source: USEPA, 1989a

PARSONS
PARSONS ENGINEERING SCIENCE, INC

CLIENT/PROJECT TITLE
SENECA ARMY DEPOT ACTIVITY
ACTIVE DEACTIVATION FURNACE
SEAD 17

DEPT ENVIRONMENTAL ENGINEERING
DWG NO. 729895-01001

FIGURE 7-1

BASELINE RISK ASSESSMENT PROCESS

SCALE Not Applicable
DATE JANUARY 1997

H:\ENG\SENECA\S2526RI\RISK\HUMAN\RISKTABL\26\FIG7-1.CDR

2. Exposure Assessment (Section 7.3)

This section includes derivation and presentation of the applicable exposure point concentrations (EPCs) used in the human health risk assessment. Exposure point concentrations for the baseline risk assessment are based on analytical data and modeling results. The EPCs provided are used for both current and future onsite land-use scenarios, and correspond to the applicable exposure pathways for the baseline risk assessment. The calculated risk values for all exposure scenarios are presented in two forms: Reasonable Maximum Exposure (RME) and Central Tendency (CT), based on Superfund guidance.

For the current land-use scenario, the only potentially exposed site receptors are site workers. For the future on-site land-use scenarios, industrial workers, construction workers, a child trespasser, and adult workers and children at an on-site day care center are the relevant exposed populations. In all scenarios, the calculated risk values apply to a hypothetical RME and CT individual working on or visiting the site, and the risk values are dictated by the collected environmental sampling data used in the risk assessment as exposure point concentrations for the applicable media.

The three primary exposure routes considered in the baseline risk assessment are ingestion, inhalation, and dermal contact. Chemical intake values for both current and future land use are calculated based on exposure pathways, specific exposure values, and assumptions made for the RME and CT. Equations used to calculate intakes for all applicable exposure pathways are presented in this section. Detailed exposure/risk calculation spreadsheets are included in Appendix J.

3. Toxicity Assessment (Section 7.4)

This section presents oral, inhalation, and dermal toxicity values used in the human health risk calculations. Appropriate data sources (i.e. IRIS, HEAST and EPA Risk Assessment Issue Papers) are provided to support the toxicity values.

4. Risk Characterization (Section 7.5)

This section presents the risk calculations for all human health exposure pathways for current and future land use. Non-carcinogenic and carcinogenic risk estimates are summarized for each receptor and exposure pathway. Detailed Hazard Quotients and Carcinogenic Risk calculations are included in Appendix J.

5. Ecological Risk Assessment (Section 7.6)

This section provides an identification and characterization of potential risks posed to environmental receptors. Included is an assessment of the ecological communities and dominant flora and fauna in the vicinity of SEAD-17, and an identification of potential pathways for receptor exposure.

6. Uncertainty (Section 7.7)

This section discusses the potential uncertainties of the methodology, assumptions, judgments, and data used in the risk assessment.

7. Summary (Section 7.8)

In this, the final section, all conclusions and results are summarized for the human health and ecological risk assessments.

7.2 IDENTIFICATION OF CHEMICALS OF CONCERN

The usability of site-related chemical data is a critical factor in assessing the human health effects of chemical contamination. The usability of these data depends on their availability, defensibility, and quality. Data availability depends on sampling history, while data defensibility depends on documentation, analytical methods, detection and reporting limits, and data validation. Data quality is measured via precision, accuracy, representativeness, completeness, and comparability.

Site-related chemical data must be managed and manipulated in order to determine representative concentrations of contaminants. Elements of data manipulation include combining multiple analyses of individual samples, incorporating results from the analyses of blind field duplicates, and addressing non-detected analytes in computing pertinent statistics. This section discusses these issues along with summarizing detected chemicals in environmental media and background.

Data collected during the RI were evaluated for suitability of use in the risk assessment as discussed in RAGS (EPA, 1989a). These decisions were based on analytical methods, quantitation limits, qualifiers, and blank contamination. The suitable RI data were then evaluated to determine relevant exposure point concentrations (EPCs) for all chemicals of potential concern, for which an exposure assessment, a toxicity assessment, and a risk characterization were performed.

7.2.1 General Site-specific Data Collection Considerations

7.2.1.1 Background Sampling

A total of 56 background soil samples and 28 background groundwater samples were compiled for this RI. Only inorganic constituents have been evaluated. Anthropogenic organic constituents have not been considered. This has produced a more conservative risk assessment since all organic constituents have been assumed to be present due to previous site activities. The results are discussed in Section 7.2.3 (Site-Specific Data Evaluation) and have been statistically compared to site data in Tables 7-2A through 7-2D. Background soil and groundwater samples from the SEAD 25 RI, 25 ESIs, the Ash Landfill, and the OB Grounds site have been combined into the background database. This was done so that the statistical evaluation of the data would be representative of the variations in the site soil and groundwater. Geologically, the soil material is identical throughout SEDA, having been deposited from the same source. This fact justifies combining the background soil and groundwater chemical composition data from all SEDA background locations into one larger database.

The background groundwater data was also subject to a criteria of having turbidity levels that were below 50 NTUs. (See NYSDEC TAGM HWR-88-4015 for the justification of using a turbidity value of 50 NTUs.) It was found that samples collected prior to implementing the USEPA's low-flow purging and pumping draft SOP, samples with high NTUs (greater than 50) had unrealistic concentrations of inorganic elements. The reported concentrations were often much higher than one could expect to be dissolved in groundwater, and it was concluded that the high reported concentrations were due to the high amount of suspended particulates in the groundwater samples. In addition, several locations were re-sampled using the draft EPA low flow purging and pumping protocols where high NTU groundwater samples had been collected in the past. The results from these locations showed that the concentrations of dissolved inorganic elements in the low NTU samples were greatly reduced when compared to the reported concentrations in those samples with high NTUs. This further reinforces the conclusion that the results from the high NTU samples were not representative of the true dissolved inorganic element concentrations in the background groundwater.

7.2.1.2 Sampling Locations and Media

Four media were sampled during the SEAD-17 RI: soil, groundwater, surface water, and sediment. Surface soils were collected from 49 locations, subsurface soils were collected from four locations, groundwater samples were collected from four locations, and surface water and sediment samples were collected from 10 locations. The Study Area Investigation, SEAD-17 section of this report (Section 2.4) presents detailed descriptions of all media samples that have been collected from SEAD-17.

7.2.1.3 Sampling Methods

Detailed sampling methods are described in Section 2 , however a brief description of the sampling of the five media, surface water, sediment, soil, groundwater and air is provided below.

Surface water samples were collected from several locations on the site by directly filling the appropriate sample containers, or when the water depth was relatively shallow, sample containers were filled by bailing water into sample containers with a decontaminated glass beaker. Sediment samples were collected by scooping sediment into a decontaminated stainless steel bowl with a decontaminated trowel. Volatile organic analyte (VOA) samples were taken first, prior to any mixing of the sediments. Then, the bowl was refilled with additional sediment, if required, thoroughly mixed and the appropriate sample containers filled with sediment.

Soil borings were performed using a drilling rig equipped with 4.25-inch hollow stem augers. All borings were advanced to refusal on competent bedrock. During drilling, soil samples were collected continuously at 2-foot intervals using a decontaminated 2 or 1.5 foot split spoon sampler according to the method described in ASTM-D 1586-84. Three soil samples were collected for level IV analysis from each boring. Samples were collected from the surface (0 to 0.5 feet), at an intermediate zone (between 0.5 and 4 feet), and from the top of the water table, except where geologic or water table conditions prevented the collection of these samples. During the RI groundwater sampling program, groundwater monitoring wells were sampled according to the Draft EPA SOP titled Groundwater Sampling Procedure, Low Flow Pump Purging and Sampling (EPA, May 15, 1995).

7.2.1.4 QA/QC Methods

QA/QC samples were analyzed for the purpose of assessing the quality of the sampling effort and the analytical data. The QA/QC samples included splits, replicates, field equipment blanks, trip blanks, and matrix spike/matrix spike duplicates. Split samples were analyzed by an EPA contract laboratory and the Corps of Engineers Missouri River Division (MRD) to assess the quality of the analytical data. One replicate sample was collected per batch of 20 or fewer samples per matrix. A field equipment blank was collected at a rate of one per field equipment decontaminated event to detect possible sources of contamination introduced from field sampling equipment or from carry over from one sample to the next. One trip blank was collected per day of water sampling for VOCs and was analyzed for VOCs to determine if samples were contaminated during transit. For each group of 20 or less samples per matrix, additional sample volume was collected (for water samples) or an individual sample was selected and was used for matrix spike and matrix spike duplicate analyses. The use of matrix spikes gives insight to the analytical proficiency and efficiency of the analytical methods and indicates if the sample matrix may be attenuating or augmenting the reported analytical results.

7.2.1.5 Analytical Methods

NYSDEC CLP statement of work methods were used for the analysis of organic and inorganic constituents in soil, sediment, groundwater, and surface water. Herbicides, explosives, and nitrates were analyzed using EPA Methods 8150, 8330, and 353.2, respectively.

7.2.2 Data Usability

The data usability criteria for documentation, analytical methods, data validation, precision, accuracy, representativeness, comparability, and completeness are discussed in this section.

The RI data was collected during two investigations, the SEAD-17 and 17 ESI and the SEAD-17 and 17 Phase I RI. The ESI began in November 1993, and ended in February 1994. The Phase I RI began in August 1996 and ended in September 1996.

The data used for the risk assessment were grouped into seven databases, one for each of the exposure route/exposure scenarios that were developed from the exposure point pathway models. Each database contains data that is specific for one of the following types of media: surface soils (defined as soil samples collected from 0 to 6 inches below grade), surface and subsurface soils (i.e. all soils data), surface and subsurface soils to a depth of four feet (for the burrowing animal pathway of the ecological risk assessment), groundwater, surface water, sediments and air.

The following sections describe the processes by which the data were analyzed, examined, and reduced to arrive at a list of analytes, for each exposure pathway, that were quantified for use in the baseline human health and ecological risk assessments.

7.2.2.1 Documentation

Documentation of sample collection and laboratory analysis is essential in order to authenticate conclusions derived from data. Standard operating procedures (SOPs) for field collection of samples are in Appendix A of the Project Workplan, and were followed during sample collection. Formal chain-of-custody records that included sample IDs, date sampled, sample collector, analyses and methods required, matrix, preservation per analysis, and comments were maintained.

Laboratory SOPs were used for all analyses required. Deviations from these SOPs were documented in case narratives that were part of each sample delivery group (SDG). Deviations from these SOPs were minor and did not adversely affect data quality.

7.2.2.2 Evaluation of Analytical Methods

All data used in the risk assessment were generated using level IV CLP protocols. Although level I field screening data were collected as part of the RI, it was not used in the quantitative risk assessment. Since the RI/FS ultimately requires decisions regarding future site remedial actions, the data collected must be of sufficient quantity to support this decision making process. The CLP was developed to ensure that consistent QA/QC methods are used when evaluating Superfund site samples. However, this does not mean that all CLP data is automatically of sufficient quality and reliability for use in the quantitative risk assessment.

The data used in this baseline risk assessment was validated in compliance with EPA Region II validation guidelines. The following criteria were considered and used to validate the data: spike/matrix spike duplicates, field duplicates, internal standard performance, compound identification, compound quantitation, spike sample recovery for metals, laboratory duplicates for metals, interference for metals, and qualifiers. Several steps were taken to ensure that the data was appropriate and reliable for use in the risk assessment. These steps, such as evaluation of quantitation limits, are discussed in the following sections.

7.2.2.3 Evaluation of Quantitation Limits and Data Reduction

Five points were considered when evaluating methods and reducing data based on sample quantitation limits (SQLs). These were 1) SQLs and their relation to reference concentrations, 2) unusually high SQLs, 3) when only some samples in a medium test positive for a chemical, 4) when SQLs are not available, and 5) when chemicals are not detected in any sample in a medium. Each of these points is discussed below.

SQLs and their relation to reference concentrations

To ensure that volatile organic analyses of groundwater could be compared to reference standards, the Phase II samples were analyzed using Method 524.2 with a level IV data package (to attain the lower sample quantitation limits) when the Phase I results had a majority of volatile organic compounds that were not detected using the NYSDEC CLP analysis.

Unusually high SQLs

The data in each of the databases for SEAD-17 were evaluated to determine if there were any unusually high SQLs. The mean and the standard deviation of the normal data were calculated for each analyte in each of the databases for SEAD-17. The 95th percentile upper confidence limit (95th UCL) of the mean of the normal data was then calculated as follows:

$$95\%\, UCL = \overline{X} + t\left(s / n^{0.5}\right)$$

where:

$\overline{X}$ = the mean concentration
s = the standard deviation of the sample results
n = the number of samples
t = Student-t statistic for a one tailed t-test at the 95th confidence level

The 95th UCL is the value for which there is 95 percent confidence that the actual site mean does not exceed this value.

Unusually high SQLs that caused the 95th UCL of the normal data to exceed the actual maximum detected value were eliminated in accordance with RAGS (Section 5.3.2) guidance. The 95th UCL was then recalculated and the comparison repeated until either no unusually high SQLs caused the 95th UCL to exceed the maximum detected value or all unusually high SQLs had been eliminated.

Only some samples in a medium test positive for a chemical

Sometimes only some samples in a medium tested positively for a chemical. In the other samples the chemical was not measured above the quantitation limit, but it could of course be present just below the quantitation limit or it may not be there at all. To account for these possibilities, non-detected results were included in the risk assessment at one-half the SQL.

SQLs not available

SQLs were provided by the laboratory for every analyte that was not detected so no adjustment had to be made for non-detects without SQLs.

Chemicals are not detected in any sample in a medium

If for a given analyte in a medium, the validated results were all non-detects or rejected (qualifier = U, UJ, UR, JR or R), that analyte was eliminated from the risk assessment for that particular medium.

7.2.2.4 Evaluation of Qualified and Coded Data

Qualifiers are attached to data by laboratories conducting analyses and by data validation personnel. These qualifiers often pertain to QA/QC problems and may indicate questions concerning chemical identity, chemical concentration, or both. The qualifiers used are as follows:

U	The analyte was not detected.
UJ	The analyte was not detected; however, the associated reporting limit is approximate.
J	The analyte was positively identified; however, QC results indicate that the reported concentration may not be accurate and is therefore an estimate.
R, JR, UR	The analyte was rejected due to laboratory QC deficiencies, sample preservation problems, or holding time exceedance. The presence or absence of the analyte cannot be determined.

Before data was used in the quantitative risk assessment all qualifiers were addressed. This was done according to the prescribed data validation procedures. The end result of the data validation was four possible situations: 1) the data was rejected by either laboratory or data validation personnel and considered unusable (R, JR, UR), 2) the compound was analyzed for but was not detected (U), 3) the data was an estimated value (J), or 4) the data was unqualified. Data that was not detected by the laboratory (U) and was assigned a J by the data validation personnel, is considered a non-detect for the risk assessment (UJ).

7.2.2.5 Chemicals in Blanks

Blanks are QC samples analyzed in the same manner as environmental samples, and provide a means of identifying possible contamination of environmental samples. Sources of contamination include the laboratory, the sampling environment, and the sampling equipment. To address contamination, three types of blanks were analyzed: method blanks, trip blanks, and equipment rinseates. Method blanks consisted of laboratory reagent water or pre-purified and extracted sand taken through the same analytical process as environmental samples. Trip blanks consisted of distilled water poured into a 40-milliliter glass vial and sealed with a Teflon septum for soil and water samples. The trip blanks accompanied sample bottles to the field during sample collection. Trip blanks were not opened during sample collection. Equipment rinseates consisted of deionized water poured into or pumped through sampling devices and then transferred to sample bottles.

According to the data validation guidelines, if the blank contained detectable levels of a common laboratory contaminant, then the sample results were considered positive results (unqualified hit) only if the concentration in the sample exceeded ten times the maximum amount detected in any blank. If the concentration in the sample was less than ten times the maximum amount detected in the blank, it was concluded that the chemical was not detected. Common laboratory contaminants are acetone, 2-butanone, methylene chloride, toluene, and phthalate esters. If the blank contained detectable levels of a chemical that is not a common laboratory contaminant, then the sample results were considered positive results (unqualified hit) only if the concentration in the sample exceeded five times the maximum amount detected in any blank. If the concentration in the sample was less than five times the maximum amount detected in the blank, it was concluded that the chemical was not detected. This procedure was performed as part of the data validation.

7.2.2.6 Precision

The term precision is used to describe the reproducibility of results. It can be defined as the agreement between the numerical values of two or more measurements resulting from the same process. In the case of chemical analyses, precision is determined through the analyses of duplicate environmental samples. Duplicate sample analyses include matrix spikes, blank spikes, blind field duplicates, and replicate instrumental analyses of individual environmental samples.

Matrix spikes involve the introduction of compounds or elements to samples of known concentrations. The assumption is that these introduced compounds will be recovered from environmental samples to the same degree as in matrix spikes. Blank spikes involve the introduction of compounds or elements to laboratory reagent water or pre-purified and extracted sand. Blank spikes eliminate the possibility of matrix interferences or contributions, thereby monitoring analytical performance from sample preparation to analysis. Blind field duplicates are samples labeled with a fictitious sample ID taken from an existing sampling location. They are collected simultaneously with a properly labeled sample and provide the most legitimate means of assessing precision.

Precision estimates were obtained using the relative percent difference (RPD) between duplicate analyses. Overall precision, as well as precision control limits, were estimated using a weighted combination of RPDs from spikes and duplicate analyses. Precision and RPD were acceptable.

7.2.2.7 Accuracy

Accuracy is the degree to which a measurement represents the true value of that parameter. Estimates of accuracy are more difficult to obtain than precision since accuracy requires knowledge of the quantity desired. In the case of chemical analyses, accuracy is determined through the introduction of compounds or elements to samples of known concentrations, or analytical spikes. The assumption is that compounds will be recovered from environmental samples to the same degree as in analytical spikes.

Two types of compounds were added to environmental samples for assessing accuracy: surrogate compounds and matrix spike compounds. Surrogates are compounds that closely approximate target analytes in structure, but are not target analytes. Surrogate compounds generally are added to samples in the preparation stages and monitor the effectiveness of the preparation process. Matrix spike compounds are target analytes that are added based upon expectations of matrix interferences, that impede analyte detection. Laboratory method blank samples were spiked with surrogate compounds, per analysis day, as an additional means of estimating accuracy. The accuracy of chemical analyses was estimated using the percent recovery (PR) of compounds or elements that were added to analytical spikes. Accuracy and PR were acceptable.

7.2.2.8 Representativeness

Representativeness expresses the extent to which sample data characterize the population or environmental media. Factors influencing representativeness include sample collection, selection of sampling locations representative of site conditions, and use of appropriate chemical methods for sample analyses. Chemical analysis methods are addressed in Section 7.2.2.2. Sampling from locations representative of site conditions was achieved through implementation of the approved field sampling plan. Blind field duplicates were collected and analyzed in order to assess the influence of sample collection on representativeness. Approximately 5 percent of field samples were collected in duplicate. Representativeness was estimated using the RPD between blind field duplicates and was acceptable.

7.2.2.9 Comparability

Comparability is a data characteristic that measures the ability to compare data from a laboratory with data from others. Comparability factors include the use of standard analytical methodologies, data reported in standard or consistent units, appropriate frequency of applicable QC analyses, and laboratory participation in appropriate performance evaluation studies. All data were reported in appropriate and acceptable units. The laboratory performing the CLP inorganic and organic analyses participated in the quarterly USEPA blind performance evaluation program and the MRD performance evaluation program. Their performance in this program was acceptable.

7.2.2.10 Completeness

Completeness measures the amount of usable data relative to the amount of samples collected and analyzed. The completeness goal in the project workplan was 90 percent. Completeness was acceptable.

7.2.2.11 Tentatively Identified Compounds

Tentatively identified compounds (TICs) are compounds not specified on the Target Analyte List for quantification but were identified in the sample. TICs were grouped into two major classes: identified compounds and unknown compounds. Chromatographic peaks determined by the laboratory to be a unique compound were identified and quantified. Chromatographic peaks were identified through mass spectral library searches during sample analyses. Chromatographic peaks that failed absolute identification through mass spectral library searches were categorized into general classes by the laboratory. Although a significant number of TICs were detected in the soil samples, they are predominantly unknown alkanes, unknown aliphatic compounds and unknown PAHs, and are not included in the quantitative risk assessment, but are generally discussed in Section 7.5.1.3.

7.2.3 Site-specific Data Evaluation Considerations

Two major criteria were used to evaluate and select analytes that would be used in the quantitative risk assessment. The first criteria was applied to all of the analytes that were analyzed for in each database and consisted of selecting only those analytes that were detected in one or more of the environmental samples. The second criteria was applied only to the inorganic analyte data and consisted of determining if any analytes were present in the SEAD-17 sample populations at concentrations that tended to be above those found in background sample populations. The following paragraphs describe the various steps that were used to implement these criteria.

The first step in evaluating the data from SEAD-17 was to create the seven media-specific databases. Each database was examined separately in the site-specific data evaluations.

The data used in the databases (and the quantitative risk assessments) was validated as described previously. The data in each database was then reviewed and all compounds that were not detected in any sample in a particular database were deleted from that database, consistent with RAGs guidance. Table 7-1 summarizes the list of chemicals that were deleted from each of the databases for SEAD-17.

An intermediate step, which did not reduce the list of analytes any further but did eliminate data that would have "caused the calculated exposure concentration to exceed the maximum detected concentration" (EPA, 1989a), is the procedure by which samples were eliminated due to unusually high quantitation limits. This procedure is discussed in Section 7.2.2.3.

At this stage all qualifiers were no longer considered in the data analyses. For all subsequent operations that involved the use of data from the databases, all results with either no qualifier or a J qualifier were taken at full value and all non-detect (U or UJ qualifier) results were taken at half of the value.

A statistical analysis was then performed on the inorganic analytes in the soils and groundwater databases to determine whether or not the site population of a particular analyte and the background population for that same analyte were drawn from the same mean. Site populations in a particular database that were shown to be drawn from the same mean as the background population were considered to be indistinguishable from background and were deleted from that database. This statistical analysis was applied only to the inorganic analytes in the soil and groundwater databases, which were compared to the 56 sample background soils database and the 28 sample bakcground groundwater database, respectively.

TABLE 7-1

SEAD-17 RI
Analytes Not Detected in Any Sample

Chemical Class	Analyte Name	Media
HERBICIDES	2,4,5-T	GROUNDWATER
HERBICIDES	2,4,5-TP/Silvex	GROUNDWATER
HERBICIDES	2,4-D	GROUNDWATER
HERBICIDES	2,4-DB	GROUNDWATER
HERBICIDES	Dalapon	GROUNDWATER
HERBICIDES	Dicamba	GROUNDWATER
HERBICIDES	Dichloroprop	GROUNDWATER
HERBICIDES	Dinoseb	GROUNDWATER
HERBICIDES	MCPA	GROUNDWATER
HERBICIDES	MCPP	GROUNDWATER
SEMIVOLATILE ORGANICS	2,2'-oxybis(1-Chloropropane)	GROUNDWATER
VOLATILE ORGANICS	1,2-Dichloroethene (total)	GROUNDWATER
METALS	Cyanide	SEDIMETALSENT
METALS	Silver	SEDIMENT
PESTICIDES/PCB	Aldrin	SEDIMENT
PESTICIDES/PCB	Alpha-BhC	SEDIMENT
PESTICIDES/PCB	Alpha-Chlordane	SEDIMENT
PESTICIDES/PCB	Aroclor-1016	SEDIMENT
PESTICIDES/PCB	Aroclor-1221	SEDIMENT
PESTICIDES/PCB	Aroclor-1232	SEDIMENT
PESTICIDES/PCB	Aroclor-1242	SEDIMENT
PESTICIDES/PCB	Aroclor-1248	SEDIMENT
PESTICIDES/PCB	Aroclor-1254	SEDIMENT
PESTICIDES/PCB	Aroclor-1260	SEDIMENT
PESTICIDES/PCB	Beta-BhC	SEDIMENT
PESTICIDES/PCB	Delta-BhC	SEDIMENT
PESTICIDES/PCB	Endosulfan sulfate	SEDIMENT
PESTICIDES/PCB	Endrin	SEDIMENT
PESTICIDES/PCB	Endrin aldehyde	SEDIMENT
PESTICIDES/PCB	Endrin ketone	SEDIMENT
PESTICIDES/PCB	Gamma-BhC/Lindane	SEDIMENT
PESTICIDES/PCB	Gamma-Chlordane	SEDIMENT
PESTICIDES/PCB	heptachlor	SEDIMENT
PESTICIDES/PCB	heptachlor epoxide	SEDIMENT
PESTICIDES/PCB	Methoxychlor	SEDIMENT
PESTICIDES/PCB	Toxaphene	SEDIMENT
SEMIVOLATILE ORGANICS	1,2,4-Trichlorobenzene	SEDIMENT
SEMIVOLATILE ORGANICS	1,2-Dichlorobenzene	SEDIMENT
SEMIVOLATILE ORGANICS	1,3,5-Trinitrobenzene	SEDIMENT
SEMIVOLATILE ORGANICS	1,3-Dichlorobenzene	SEDIMENT
SEMIVOLATILE ORGANICS	1,3-Dinitrobenzene	SEDIMENT
SEMIVOLATILE ORGANICS	1,4-Dichlorobenzene	SEDIMENT
SEMIVOLATILE ORGANICS	2,4,5-Trichlorophenol	SEDIMENT
SEMIVOLATILE ORGANICS	2,4,6-Trichlorophenol	SEDIMENT
SEMIVOLATILE ORGANICS	2,4,6-Trinitrotoluene	SEDIMENT
SEMIVOLATILE ORGANICS	2,4-Dichlorophenol	SEDIMENT
SEMIVOLATILE ORGANICS	2,4-Dinitrophenol	SEDIMENT

TABLE 7-1

SEAD-17 RI
Analytes Not Detected in Any Sample

Chemical Class	Analyte Name	Media
SEMIVOLATILE ORGANICS	2,6-Dinitrotoluene	SEDIMENT
SEMIVOLATILE ORGANICS	2-Chloronaphthalene	SEDIMENT
SEMIVOLATILE ORGANICS	2-Chlorophenol	SEDIMENT
SEMIVOLATILE ORGANICS	2-Methylnaphthalene	SEDIMENT
SEMIVOLATILE ORGANICS	2-Methylphenol	SEDIMENT
SEMIVOLATILE ORGANICS	2-Nitroaniline	SEDIMENT
SEMIVOLATILE ORGANICS	2-Nitrophenol	SEDIMENT
SEMIVOLATILE ORGANICS	2-Nitrotoluene	SEDIMENT
SEMIVOLATILE ORGANICS	2-amino-4,6-Dinitrotoluene	SEDIMENT
SEMIVOLATILE ORGANICS	3,3`-Dichlorobenzidine	SEDIMENT
SEMIVOLATILE ORGANICS	3-Nitroaniline	SEDIMENT
SEMIVOLATILE ORGANICS	3-Nitrotoluene	SEDIMENT
SEMIVOLATILE ORGANICS	4,6-Dinitro-2-methylphenol	SEDIMENT
SEMIVOLATILE ORGANICS	4-Bromophenyl phenyl ether	SEDIMENT
SEMIVOLATILE ORGANICS	4-Chloro-3-methylphenol	SEDIMENT
SEMIVOLATILE ORGANICS	4-Chloroaniline	SEDIMENT
SEMIVOLATILE ORGANICS	4-Chlorophenyl phenyl ether	SEDIMENT
SEMIVOLATILE ORGANICS	4-Methylphenol	SEDIMENT
SEMIVOLATILE ORGANICS	4-Nitroaniline	SEDIMENT
SEMIVOLATILE ORGANICS	4-Nitrophenol	SEDIMENT
SEMIVOLATILE ORGANICS	4-Nitrotoluene	SEDIMENT
SEMIVOLATILE ORGANICS	4-amino-2,6-Dinitrotoluene	SEDIMENT
SEMIVOLATILE ORGANICS	Acenaphthene	SEDIMENT
SEMIVOLATILE ORGANICS	Acenaphthylene	SEDIMENT
SEMIVOLATILE ORGANICS	Anthracene	SEDIMENT
SEMIVOLATILE ORGANICS	Bis(2-Chloroethoxy)methane	SEDIMENT
SEMIVOLATILE ORGANICS	Bis(2-Chloroethyl)ether	SEDIMENT
SEMIVOLATILE ORGANICS	Bis(2-Chloroisopropyl)ether	SEDIMENT
SEMIVOLATILE ORGANICS	Butylbenzylphthalate	SEDIMENT
SEMIVOLATILE ORGANICS	Carbazole	SEDIMENT
SEMIVOLATILE ORGANICS	Di-n-butylphthalate	SEDIMENT
SEMIVOLATILE ORGANICS	Di-n-octylphthalate	SEDIMENT
SEMIVOLATILE ORGANICS	Dibenz[a,h]anthracene	SEDIMENT
SEMIVOLATILE ORGANICS	Dibenzofuran	SEDIMENT
SEMIVOLATILE ORGANICS	Diethyl phthalate	SEDIMENT
SEMIVOLATILE ORGANICS	Dimethylphthalate	SEDIMENT
SEMIVOLATILE ORGANICS	Fluorene	SEDIMENT
SEMIVOLATILE ORGANICS	hMX	SEDIMENT
SEMIVOLATILE ORGANICS	hexachlorobenzene	SEDIMENT
SEMIVOLATILE ORGANICS	hexachlorobutadiene	SEDIMENT
SEMIVOLATILE ORGANICS	hexachlorocyclopentadiene	SEDIMENT
SEMIVOLATILE ORGANICS	hexachloroethane	SEDIMENT
SEMIVOLATILE ORGANICS	Isophorone	SEDIMENT
SEMIVOLATILE ORGANICS	N-Nitrosodiphenylamine	SEDIMENT
SEMIVOLATILE ORGANICS	N-Nitrosodipropylamine	SEDIMENT
SEMIVOLATILE ORGANICS	Naphthalene	SEDIMENT
SEMIVOLATILE ORGANICS	Nitrobenzene	SEDIMENT

TABLE 7-1

SEAD-17 RI
Analytes Not Detected in Any Sample

Chemical Class	Analyte Name	Media
SEMIVOLATILE ORGANICS	Pentachlorophenol	SEDIMENT
SEMIVOLATILE ORGANICS	Phenol	SEDIMENT
SEMIVOLATILE ORGANICS	RDX	SEDIMENT
SEMIVOLATILE ORGANICS	Tetryl	SEDIMENT
VOLATILE ORGANICS	1,1,1-Trichloroethane	SEDIMENT
VOLATILE ORGANICS	1,1,2,2-Tetrachloroethane	SEDIMENT
VOLATILE ORGANICS	1,1,2-Trichloroethane	SEDIMENT
VOLATILE ORGANICS	1,1-Dichloroethane	SEDIMENT
VOLATILE ORGANICS	1,1-Dichloroethene	SEDIMENT
VOLATILE ORGANICS	1,2-Dichlorobenzene	SEDIMENT
VOLATILE ORGANICS	1,2-Dichloroethane	SEDIMENT
VOLATILE ORGANICS	1,2-Dichloroethene (total)	SEDIMENT
VOLATILE ORGANICS	1,2-Dichloropropane	SEDIMENT
VOLATILE ORGANICS	1,3-Dichlorobenzene	SEDIMENT
VOLATILE ORGANICS	1,4-Dichlorobenzene	SEDIMENT
VOLATILE ORGANICS	Benzene	SEDIMENT
VOLATILE ORGANICS	Bromodichloromethane	SEDIMENT
VOLATILE ORGANICS	Bromoform	SEDIMENT
VOLATILE ORGANICS	Carbon disulfide	SEDIMENT
VOLATILE ORGANICS	Carbon tetrachloride	SEDIMENT
VOLATILE ORGANICS	Chlorobenzene	SEDIMENT
VOLATILE ORGANICS	Chlorodibromomethane	SEDIMENT
VOLATILE ORGANICS	Chloroethane	SEDIMENT
VOLATILE ORGANICS	Chloroform	SEDIMENT
VOLATILE ORGANICS	Cis-1,3-Dichloropropene	SEDIMENT
VOLATILE ORGANICS	Ethyl benzene	SEDIMENT
VOLATILE ORGANICS	Methyl bromide	SEDIMENT
VOLATILE ORGANICS	Methyl butyl ketone	SEDIMENT
VOLATILE ORGANICS	Methyl chloride	SEDIMENT
VOLATILE ORGANICS	Methyl ethyl ketone	SEDIMENT
VOLATILE ORGANICS	Methyl isobutyl ketone	SEDIMENT
VOLATILE ORGANICS	Methylene chloride	SEDIMENT
VOLATILE ORGANICS	Styrene	SEDIMENT
VOLATILE ORGANICS	Tetrachloroethene	SEDIMENT
VOLATILE ORGANICS	Total Xylenes	SEDIMENT
VOLATILE ORGANICS	Trans-1,3-Dichloropropene	SEDIMENT
VOLATILE ORGANICS	Trichloroethene	SEDIMENT
VOLATILE ORGANICS	Vinyl chloride	SEDIMENT
HERBICIDES	2,4,5-T	SOIL
HERBICIDES	2,4,5-TP/Silvex	SOIL
HERBICIDES	2,4-D	SOIL
HERBICIDES	2,4-DB	SOIL
HERBICIDES	Dalapon	SOIL
HERBICIDES	Dicamba	SOIL
HERBICIDES	Dichloroprop	SOIL
HERBICIDES	Dinoseb	SOIL
HERBICIDES	MCPP	SOIL

TABLE 7-1

SEAD-17 RI
Analytes Not Detected in Any Sample

Chemical Class	Analyte Name	Media
PESTICIDES/PCB	Alpha-BhC	SOIL
PESTICIDES/PCB	Aroclor-1016	SOIL
PESTICIDES/PCB	Aroclor-1221	SOIL
PESTICIDES/PCB	Aroclor-1232	SOIL
PESTICIDES/PCB	Aroclor-1242	SOIL
PESTICIDES/PCB	Aroclor-1248	SOIL
PESTICIDES/PCB	Endosulfan II	SOIL
PESTICIDES/PCB	Endrin aldehyde	SOIL
PESTICIDES/PCB	Gamma-BhC/Lindane	SOIL
PESTICIDES/PCB	Gamma-Chlordane	SOIL
PESTICIDES/PCB	heptachlor	SOIL
PESTICIDES/PCB	Methoxychlor	SOIL
PESTICIDES/PCB	Toxaphene	SOIL
SEMIVOLATILE ORGANICS	1,2,4-Trichlorobenzene	SOIL
SEMIVOLATILE ORGANICS	1,2-Dichlorobenzene	SOIL
SEMIVOLATILE ORGANICS	1,3,5-Trinitrobenzene	SOIL
SEMIVOLATILE ORGANICS	1,3-Dichlorobenzene	SOIL
SEMIVOLATILE ORGANICS	1,3-Dinitrobenzene	SOIL
SEMIVOLATILE ORGANICS	1,4-Dichlorobenzene	SOIL
SEMIVOLATILE ORGANICS	2,2'-oxybis(1-Chloropropane)	SOIL
SEMIVOLATILE ORGANICS	2,4,5-Trichlorophenol	SOIL
SEMIVOLATILE ORGANICS	2,4,6-Trichlorophenol	SOIL
SEMIVOLATILE ORGANICS	2,4,6-Trinitrotoluene	SOIL
SEMIVOLATILE ORGANICS	2,4-Dichlorophenol	SOIL
SEMIVOLATILE ORGANICS	2,4-Dimethylphenol	SOIL
SEMIVOLATILE ORGANICS	2,4-Dinitrophenol	SOIL
SEMIVOLATILE ORGANICS	2-Chloronaphthalene	SOIL
SEMIVOLATILE ORGANICS	2-Chlorophenol	SOIL
SEMIVOLATILE ORGANICS	2-Nitroaniline	SOIL
SEMIVOLATILE ORGANICS	2-Nitrophenol	SOIL
SEMIVOLATILE ORGANICS	2-amino-4,6-Dinitrotoluene	SOIL
SEMIVOLATILE ORGANICS	4,6-Dinitro-2-methylphenol	SOIL
SEMIVOLATILE ORGANICS	4-Bromophenyl phenyl ether	SOIL
SEMIVOLATILE ORGANICS	4-Chloro-3-methylphenol	SOIL
SEMIVOLATILE ORGANICS	4-Chloroaniline	SOIL
SEMIVOLATILE ORGANICS	4-Chlorophenyl phenyl ether	SOIL
SEMIVOLATILE ORGANICS	4-Methylphenol	SOIL
SEMIVOLATILE ORGANICS	4-Nitrophenol	SOIL
SEMIVOLATILE ORGANICS	4-amino-2,6-Dinitrotoluene	SOIL
SEMIVOLATILE ORGANICS	Bis(2-Chloroethoxy)methane	SOIL
SEMIVOLATILE ORGANICS	Bis(2-Chloroethyl)ether	SOIL
SEMIVOLATILE ORGANICS	Di-n-octylphthalate	SOIL
SEMIVOLATILE ORGANICS	Diethyl phthalate	SOIL
SEMIVOLATILE ORGANICS	Dimethylphthalate	SOIL
SEMIVOLATILE ORGANICS	hMX	SOIL
SEMIVOLATILE ORGANICS	hexachlorobenzene	SOIL
SEMIVOLATILE ORGANICS	hexachlorobutadiene	SOIL

TABLE 7-1

SEAD-17 RI
Analytes Not Detected in Any Sample

Chemical Class	Analyte Name	Media
SEMIVOLATILE ORGANICS	hexachlorocyclopentadiene	SOIL
SEMIVOLATILE ORGANICS	hexachloroethane	SOIL
SEMIVOLATILE ORGANICS	Isophorone	SOIL
SEMIVOLATILE ORGANICS	N-Nitrosodipropylamine	SOIL
SEMIVOLATILE ORGANICS	Nitrobenzene	SOIL
SEMIVOLATILE ORGANICS	Phenol	SOIL
SEMIVOLATILE ORGANICS	RDX	SOIL
SEMIVOLATILE ORGANICS	Tetryl	SOIL
VOLATILE ORGANICS	1,1,1-Trichloroethane	SOIL
VOLATILE ORGANICS	1,1,2,2-Tetrachloroethane	SOIL
VOLATILE ORGANICS	1,1,2-Trichloroethane	SOIL
VOLATILE ORGANICS	1,1-Dichloroethane	SOIL
VOLATILE ORGANICS	1,1-Dichloroethene	SOIL
VOLATILE ORGANICS	1,2-Dichlorobenzene	SOIL
VOLATILE ORGANICS	1,2-Dichloroethane	SOIL
VOLATILE ORGANICS	1,2-Dichloroethene (total)	SOIL
VOLATILE ORGANICS	1,2-Dichloropropane	SOIL
VOLATILE ORGANICS	1,3-Dichlorobenzene	SOIL
VOLATILE ORGANICS	1,4-Dichlorobenzene	SOIL
VOLATILE ORGANICS	Bromodichloromethane	SOIL
VOLATILE ORGANICS	Bromoform	SOIL
VOLATILE ORGANICS	Carbon disulfide	SOIL
VOLATILE ORGANICS	Carbon tetrachloride	SOIL
VOLATILE ORGANICS	Chlorobenzene	SOIL
VOLATILE ORGANICS	Chlorodibromomethane	SOIL
VOLATILE ORGANICS	Chloroethane	SOIL
VOLATILE ORGANICS	Chloroform	SOIL
VOLATILE ORGANICS	Cis-1,3-Dichloropropene	SOIL
VOLATILE ORGANICS	Ethyl benzene	SOIL
VOLATILE ORGANICS	Methyl bromide	SOIL
VOLATILE ORGANICS	Methyl butyl ketone	SOIL
VOLATILE ORGANICS	Methyl chloride	SOIL
VOLATILE ORGANICS	Methyl ethyl ketone	SOIL
VOLATILE ORGANICS	Methyl isobutyl ketone	SOIL
VOLATILE ORGANICS	Styrene	SOIL
VOLATILE ORGANICS	Tetrachloroethene	SOIL
VOLATILE ORGANICS	Total Xylenes	SOIL
VOLATILE ORGANICS	Trans-1,3-Dichloropropene	SOIL
VOLATILE ORGANICS	Trichloroethene	SOIL
VOLATILE ORGANICS	Vinyl chloride	SOIL
METALS	Aluminum	SURFACE WATER
METALS	Beryllium	SURFACE WATER
METALS	Cobalt	SURFACE WATER
METALS	Cyanide	SURFACE WATER
METALS	Mercury	SURFACE WATER
METALS	Silver	SURFACE WATER
METALS	Thallium	SURFACE WATER

TABLE 7-1

SEAD-17 RI
Analytes Not Detected in Any Sample

Chemical Class	Analyte Name	Media
PESTICIDES/PCB	4,4`-DDD	SURFACE WATER
PESTICIDES/PCB	4,4`-DDE	SURFACE WATER
PESTICIDES/PCB	4,4`-DDT	SURFACE WATER
PESTICIDES/PCB	Aldrin	SURFACE WATER
PESTICIDES/PCB	Alpha-BhC	SURFACE WATER
PESTICIDES/PCB	Alpha-Chlordane	SURFACE WATER
PESTICIDES/PCB	Aroclor-1016	SURFACE WATER
PESTICIDES/PCB	Aroclor-1221	SURFACE WATER
PESTICIDES/PCB	Aroclor-1232	SURFACE WATER
PESTICIDES/PCB	Aroclor-1242	SURFACE WATER
PESTICIDES/PCB	Aroclor-1248	SURFACE WATER
PESTICIDES/PCB	Aroclor-1254	SURFACE WATER
PESTICIDES/PCB	Aroclor-1260	SURFACE WATER
PESTICIDES/PCB	Beta-BhC	SURFACE WATER
PESTICIDES/PCB	Delta-BhC	SURFACE WATER
PESTICIDES/PCB	Dieldrin	SURFACE WATER
PESTICIDES/PCB	Endosulfan I	SURFACE WATER
PESTICIDES/PCB	Endosulfan II	SURFACE WATER
PESTICIDES/PCB	Endosulfan sulfate	SURFACE WATER
PESTICIDES/PCB	Endrin	SURFACE WATER
PESTICIDES/PCB	Endrin aldehyde	SURFACE WATER
PESTICIDES/PCB	Endrin ketone	SURFACE WATER
PESTICIDES/PCB	Gamma-BhC/Lindane	SURFACE WATER
PESTICIDES/PCB	Gamma-Chlordane	SURFACE WATER
PESTICIDES/PCB	heptachlor	SURFACE WATER
PESTICIDES/PCB	heptachlor epoxide	SURFACE WATER
PESTICIDES/PCB	Methoxychlor	SURFACE WATER
PESTICIDES/PCB	Toxaphene	SURFACE WATER
SEMIVOLATILE ORGANICS	1,2,4-Trichlorobenzene	SURFACE WATER
SEMIVOLATILE ORGANICS	1,2-Dichlorobenzene	SURFACE WATER
SEMIVOLATILE ORGANICS	1,3,5-Trinitrobenzene	SURFACE WATER
SEMIVOLATILE ORGANICS	1,3-Dichlorobenzene	SURFACE WATER
SEMIVOLATILE ORGANICS	1,3-Dinitrobenzene	SURFACE WATER
SEMIVOLATILE ORGANICS	1,4-Dichlorobenzene	SURFACE WATER
SEMIVOLATILE ORGANICS	2,4,5-Trichlorophenol	SURFACE WATER
SEMIVOLATILE ORGANICS	2,4,6-Trichlorophenol	SURFACE WATER
SEMIVOLATILE ORGANICS	2,4,6-Trinitrotoluene	SURFACE WATER
SEMIVOLATILE ORGANICS	2,4-Dichlorophenol	SURFACE WATER
SEMIVOLATILE ORGANICS	2,4-Dimethylphenol	SURFACE WATER
SEMIVOLATILE ORGANICS	2,4-Dinitrophenol	SURFACE WATER
SEMIVOLATILE ORGANICS	2,4-Dinitrotoluene	SURFACE WATER
SEMIVOLATILE ORGANICS	2,6-Dinitrotoluene	SURFACE WATER
SEMIVOLATILE ORGANICS	2-Chloronaphthalene	SURFACE WATER
SEMIVOLATILE ORGANICS	2-Chlorophenol	SURFACE WATER
SEMIVOLATILE ORGANICS	2-Methylnaphthalene	SURFACE WATER
SEMIVOLATILE ORGANICS	2-Methylphenol	SURFACE WATER
SEMIVOLATILE ORGANICS	2-Nitroaniline	SURFACE WATER

TABLE 7-1

SEAD-17 RI
Analytes Not Detected in Any Sample

Chemical Class	Analyte Name	Media
SEMIVOLATILE ORGANICS	2-Nitrophenol	SURFACE WATER
SEMIVOLATILE ORGANICS	2-Nitrotoluene	SURFACE WATER
SEMIVOLATILE ORGANICS	2-amino-4,6-Dinitrotoluene	SURFACE WATER
SEMIVOLATILE ORGANICS	3,3`-Dichlorobenzidine	SURFACE WATER
SEMIVOLATILE ORGANICS	3-Nitroaniline	SURFACE WATER
SEMIVOLATILE ORGANICS	3-Nitrotoluene	SURFACE WATER
SEMIVOLATILE ORGANICS	4,6-Dinitro-2-methylphenol	SURFACE WATER
SEMIVOLATILE ORGANICS	4-Bromophenyl phenyl ether	SURFACE WATER
SEMIVOLATILE ORGANICS	4-Chloro-3-methylphenol	SURFACE WATER
SEMIVOLATILE ORGANICS	4-Chloroaniline	SURFACE WATER
SEMIVOLATILE ORGANICS	4-Chlorophenyl phenyl ether	SURFACE WATER
SEMIVOLATILE ORGANICS	4-Methylphenol	SURFACE WATER
SEMIVOLATILE ORGANICS	4-Nitroaniline	SURFACE WATER
SEMIVOLATILE ORGANICS	4-Nitrophenol	SURFACE WATER
SEMIVOLATILE ORGANICS	4-Nitrotoluene	SURFACE WATER
SEMIVOLATILE ORGANICS	4-amino-2,6-Dinitrotoluene	SURFACE WATER
SEMIVOLATILE ORGANICS	Acenaphthene	SURFACE WATER
SEMIVOLATILE ORGANICS	Acenaphthylene	SURFACE WATER
SEMIVOLATILE ORGANICS	Anthracene	SURFACE WATER
SEMIVOLATILE ORGANICS	Benzo[a]anthracene	SURFACE WATER
SEMIVOLATILE ORGANICS	Benzo[a]pyrene	SURFACE WATER
SEMIVOLATILE ORGANICS	Benzo[b]fluoranthene	SURFACE WATER
SEMIVOLATILE ORGANICS	Benzo[ghi]perylene	SURFACE WATER
SEMIVOLATILE ORGANICS	Benzo[k]fluoranthene	SURFACE WATER
SEMIVOLATILE ORGANICS	Bis(2-Chloroethoxy)methane	SURFACE WATER
SEMIVOLATILE ORGANICS	Bis(2-Chloroethyl)ether	SURFACE WATER
SEMIVOLATILE ORGANICS	Bis(2-Chloroisopropyl)ether	SURFACE WATER
SEMIVOLATILE ORGANICS	Butylbenzylphthalate	SURFACE WATER
SEMIVOLATILE ORGANICS	Carbazole	SURFACE WATER
SEMIVOLATILE ORGANICS	Chrysene	SURFACE WATER
SEMIVOLATILE ORGANICS	Di-n-butylphthalate	SURFACE WATER
SEMIVOLATILE ORGANICS	Di-n-octylphthalate	SURFACE WATER
SEMIVOLATILE ORGANICS	Dibenz[a,h]anthracene	SURFACE WATER
SEMIVOLATILE ORGANICS	Dibenzofuran	SURFACE WATER
SEMIVOLATILE ORGANICS	Diethyl phthalate	SURFACE WATER
SEMIVOLATILE ORGANICS	Dimethylphthalate	SURFACE WATER
SEMIVOLATILE ORGANICS	Fluoranthene	SURFACE WATER
SEMIVOLATILE ORGANICS	Fluorene	SURFACE WATER
SEMIVOLATILE ORGANICS	hMX	SURFACE WATER
SEMIVOLATILE ORGANICS	hexachlorobenzene	SURFACE WATER
SEMIVOLATILE ORGANICS	hexachlorobutadiene	SURFACE WATER
SEMIVOLATILE ORGANICS	hexachlorocyclopentadiene	SURFACE WATER
SEMIVOLATILE ORGANICS	hexachloroethane	SURFACE WATER
SEMIVOLATILE ORGANICS	Indeno[1,2,3-cd]pyrene	SURFACE WATER
SEMIVOLATILE ORGANICS	Isophorone	SURFACE WATER
SEMIVOLATILE ORGANICS	N-Nitrosodiphenylamine	SURFACE WATER
SEMIVOLATILE ORGANICS	N-Nitrosodipropylamine	SURFACE WATER

TABLE 7-1

SEAD-17 RI
Analytes Not Detected in Any Sample

Chemical Class	Analyte Name	Media
SEMIVOLATILE ORGANICS	Naphthalene	SURFACE WATER
SEMIVOLATILE ORGANICS	Nitrobenzene	SURFACE WATER
SEMIVOLATILE ORGANICS	Pentachlorophenol	SURFACE WATER
SEMIVOLATILE ORGANICS	Phenanthrene	SURFACE WATER
SEMIVOLATILE ORGANICS	Phenol	SURFACE WATER
SEMIVOLATILE ORGANICS	Pyrene	SURFACE WATER
SEMIVOLATILE ORGANICS	RDX	SURFACE WATER
SEMIVOLATILE ORGANICS	Tetryl	SURFACE WATER
VOLATILE ORGANICS	1,1,1-Trichloroethane	SURFACE WATER
VOLATILE ORGANICS	1,1,2,2-Tetrachloroethane	SURFACE WATER
VOLATILE ORGANICS	1,1,2-Trichloroethane	SURFACE WATER
VOLATILE ORGANICS	1,1-Dichloroethane	SURFACE WATER
VOLATILE ORGANICS	1,1-Dichloroethene	SURFACE WATER
VOLATILE ORGANICS	1,2-Dichlorobenzene	SURFACE WATER
VOLATILE ORGANICS	1,2-Dichloroethane	SURFACE WATER
VOLATILE ORGANICS	1,2-Dichloroethene (total)	SURFACE WATER
VOLATILE ORGANICS	1,2-Dichloropropane	SURFACE WATER
VOLATILE ORGANICS	1,3-Dichlorobenzene	SURFACE WATER
VOLATILE ORGANICS	1,4-Dichlorobenzene	SURFACE WATER
VOLATILE ORGANICS	Acetone	SURFACE WATER
VOLATILE ORGANICS	Benzene	SURFACE WATER
VOLATILE ORGANICS	Bromodichloromethane	SURFACE WATER
VOLATILE ORGANICS	Bromoform	SURFACE WATER
VOLATILE ORGANICS	Carbon disulfide	SURFACE WATER
VOLATILE ORGANICS	Carbon tetrachloride	SURFACE WATER
VOLATILE ORGANICS	Chlorobenzene	SURFACE WATER
VOLATILE ORGANICS	Chlorodibromomethane	SURFACE WATER
VOLATILE ORGANICS	Chloroethane	SURFACE WATER
VOLATILE ORGANICS	Chloroform	SURFACE WATER
VOLATILE ORGANICS	Cis-1,3-Dichloropropene	SURFACE WATER
VOLATILE ORGANICS	Ethyl benzene	SURFACE WATER
VOLATILE ORGANICS	Methyl bromide	SURFACE WATER
VOLATILE ORGANICS	Methyl butyl ketone	SURFACE WATER
VOLATILE ORGANICS	Methyl chloride	SURFACE WATER
VOLATILE ORGANICS	Methyl ethyl ketone	SURFACE WATER
VOLATILE ORGANICS	Methyl isobutyl ketone	SURFACE WATER
VOLATILE ORGANICS	Methylene chloride	SURFACE WATER
VOLATILE ORGANICS	Styrene	SURFACE WATER
VOLATILE ORGANICS	Tetrachloroethene	SURFACE WATER
VOLATILE ORGANICS	Toluene	SURFACE WATER
VOLATILE ORGANICS	Total Xylenes	SURFACE WATER
VOLATILE ORGANICS	Trans-1,3-Dichloropropene	SURFACE WATER
VOLATILE ORGANICS	Trichloroethene	SURFACE WATER
VOLATILE ORGANICS	Vinyl chloride	SURFACE WATER

The Wilcoxon Rank Sum test (WRS test) is the statistical method that was used to compare the on-site soil dataset to the background soil dataset and the site groundwater dataset to the background groundwater dataset. The basis for this statistical comparison was obtained from the EPA Guidance document *Statistical Methods For Evaluating The Attainment Of Cleanup Standards* (EPA, 1994) and *Statistical Methods For Environmental Pollution Monitoring* (Gilbert, 1987). Although no site-specific EPA approval was granted to apply the WRS test in this situation, the use of the WRS test as a statistical method to determine if there is a difference between contaminant concentrations in background areas and SEAD-17 is reasonable and appropriate. This form of evaluation is consistent with guidance cited in RAGS (EPA 1989a).

The hypotheses used in the application of the WRS test are:

Ho (the null hypothesis): The populations from which the two data sets have been drawn have the same mean.

Ha (the alternative hypothesis): The measurements from the site population tend to exceed those from the background populations.

where Ho is assumed to be true unless the test indicates Ho should be rejected in favor of Ha. If Ho cannot be rejected, then it is accepted that the distribution of measurements in the background area is very similar in shape and central tendency (average) to the distribution of measurements in the area being investigated. The WRS test does not require that either data set be normally distributed.

The WRS test is performed by first listing the combined background and on-site measurements from smallest to largest and assigning the ranks 1,2 etc., to the ordered values. The test handles non-detect values by treating them as ties. The methodology for treatment of ties recommended by Gilbert (1987) was followed. The ranks of the measurements from the cleanup unit are summed and used to compute the statistic Z_{rs}, which is compared to a critical value ($Z_{1-\alpha}$) from the standard normal distribution. The Z_{rs} statistic is calculated from the following formula:

$$Z_{RS} = \frac{W_{RS} - n(N+1)/2}{\left\{ \frac{mn}{12} \left[N + 1 - \frac{\sum_{j=1}^{g} t_j \left(t_j^2 - 1\right)}{N(N-1)} \right] \right\}^{1/2}}$$

where:

m = number of samples in the background dataset
n = number of samples in the on-site dataset
N = m+n
W_{rs} = the Wilcoxon Rank Sum of the on-site dataset
g = the number of tied groups
t_j = the number of tied data in the jth group

The critical value $Z_{1-\alpha}$ defines the probability that the WRS test will correctly indicate that the site and background datasets are drawn from the same population. The possibility that the WRS test will yield a false result (i.e., reject the null hypothesis when it is true) is defined by α. This type of error is called a Type I error. The overall Type I error rate (α) was selected as 0.05, which represents the 95% confidence interval. $Z_{1-\alpha}$ is found from Cumulative Standard Normal Distribution statistical tables. For a Type I error rate of 0.05, $Z_{1-\alpha}$ (or $Z_{.95}$) is equal to 1.645. If the calculated Z_{rs} statistic for a particular analyte is less than $Z_{1-\alpha}$ (1.645), the null hypothesis cannot be rejected. It is therefore concluded that, at the 95% confidence level, the measurements of that analyte in the on-site population do not tend to exceed the measurements of that analyte in the background population and that analyte is eliminated from the database.

Based upon the results of the WRS test, ten inorganic analytes were found to occur in the SEAD-17 surface soil dataset at concentrations that tend to be above those observed in the background soil measurements. They are arsenic, barium, cadmium, copper, lead, mercury, selenium, silver, thallium and zinc. Ten inorganic analytes were found to occur in the SEAD-17 all soils and zero to four foot soils datasets at concentrations that tend to be above those observed in the background soil measurements. They are antimony, arsenic, barium, cadmium, copper, lead, mercury, selenium, silver, and zinc.

For the groundwater samples, only those samples with turbidities below 50 NTUs were considered in the evaluation of site groundwater data. See Section 7.2.1.1, Background Sampling, for a discussion addressing the use of low turbidity groundwater samples. No inorganic analytes were found to occur in the SEAD-17 groundwater dataset at concentrations that tend to be above those observed in the background groundwater measurements. It should be noted that several of the analytes that were detected in SEAD-17 groundwater were not detected in a sufficient number of samples for the WRS to have sufficient power to accurately determine whether two sample sets are drawn from the same population. (See Gilbert, 1987, for a complete explanation of the requirements and constraints of using the WRS test.) These analytes are arsenic, beryllium, copper, lead, mercury, nickel, and thallium. The statistical data for these seven analytes show that their mean detected concentrations are either slightly above or are below their respective mean concentrations detected in the background data. The maximum detected on-site concentrations for arsenic, beryllium, copper, lead, nickel, and thallium were below their respective maximum detected concentrations in the background data. The highest detected on-site concentration of mercury was 0.07 ug/L and the highest detected background concentration was 0.05 ug/L. This review of the statistical data for each element demonstrates that the site data and background data are very similar and that the concentrations and distributions of inorganic analytes that were detected on-site are indistinguishable from background.

Following comments received by the USEPA, the mean of the site groundwater data were also compared to the mean of the background data. Using the methodology suggested by the USEPA, any analyte that was found in site groundwater with a mean concentration that was greater than twice the mean background concentration for that analyte was also considered in the baseline risk assessment. Using this methodology, no analytes were found to occur with mean groundwater concentrations that were greater than twice their respective mean background concentrations. Therefore, all inorganic analytes were eliminated from the SEAD-17 groundwater database and were not included in the baseline risk assessment for SEAD-17.

Tables 7-2A, 7-2B, 7-2C, and 7-2D summarize the results of the statistical comparisons, Z_{rs} statistic calculations and the Z_{rs} to $Z_{1-\alpha}$ comparisons for the surface soil dataset, the total soils dataset , the zero to four foot soils dataset, and the groundwater dataset, respectively.

7.2.4 Data Quantification for Use in the Risk Assessment

After eliminating inorganic analytes present at background levels from the risk assessment, exposure point concentrations (EPCs) were calculated for each of the remaining detected analytes in each media at SEAD 17. EPCs for both the reasonable maximum exposure (RME) and central tendency (CT) risk calculations are equal to the 95 percent upper confidence limit (UCL) of the arithmetic mean of the concentration (EPA, May 1992).

Background samples were excluded from the calculation of EPCs. Samples from MW17-1 were excluded from the EPC calculations for groundwater of SEAD-17. There were no background samples of soil, surface water or sediment collected. Prior to comments and discussions with the regulating agencies, the soil samples collected from the MW17-1 location were thought to be background soil samples. However, the concentrations of several inorganic elements in the zero

Table 7-2A
SEAD 17 RI
Inorganics Statistical Analyses
(Wilcoxon Ranked Sum Test)

Surface Soil Medium

Metals	Number of site samples n	Number of background samples m	Total samples N (m+n)	Mean n (ug/kg)	Mean m (ug/kg)	Stddev n (ug/kg)	Stddev m (ug/kg)	Min. n (ug/kg)	Min. m (ug/kg)	Max. n (ug/kg)	Max. m (ug/kg)	Mean Rank n	Mean Rank m	Wilcoxon Rank Sum n	Wilcoxon Rank Sum m	Zrs	Z(1-alpha)	Reject Null Hypothesis?
Aluminum	49	60	109	12979.59	13397.33	3273.58	4521.01	3790	5560	18400	21200	53.38	56.33	2616	3380	-0.48	1.645	NO
Antimony	49	60	109	5.38	2.81	9.24	2.88	0	0.07	52	17.1	59.74	51.13	2927	3068	1.41	1.645	NO
Arsenic	49	57	106	6.02	5.42	2.13	2.7	3.8	2.7	16.1	21.5	60.87	47.17	2983	2689	2.28	1.645	YES
Barium	49	60	109	178.76	81.05	118.78	26.72	27.2	33.9	524	159	76.23	37.66	3735	2260	6.33	1.645	YES
Beryllium	49	60	109	0.55	0.66	0.16	0.25	0.16	0.27	0.87	1.4	49.36	59.61	2419	3577	-1.68	1.645	NO
Cadmium	49	54	103	3.97	0.58	5.68	0.72	0	0.01	25.5	2.9	65.44	39.81	3207	2150	4.34	1.645	YES
Calcium	49	60	109	42476.32	48899.83	60400.07	50547.15	2180	1370	229000	293000	49.45	59.53	2423	3572	-1.65	1.645	NO
Chromium	49	60	109	19.58	20.41	4.13	6.42	9.3	10.3	27.2	35.8	53.35	56.35	2614	3381	-0.4935	1.645	NO
Cobalt	49	60	109	9.82	11.09	3.12	4.27	4.7	5.2	21.9	29.1	50.29	58.85	2464	3531	-1.4	1.645	NO
Copper	49	60	109	153.22	21.94	194.45	8.62	14.9	9.7	837	62.8	77.83	36.36	3814	2182	6.81	1.645	YES
Cyanide	49	54	103	0.31	0.28	0.19	0.04	0.05	0.21	1.5	0.41	54.15	50.05	2653	2703	0.6973	1.645	NO
Iron	49	60	109	22064.89	24656.16	4878.33	7470.55	8020	8770	29300	42500	49.91	59.16	2446	3550	-1.51	1.645	NO
Lead	49	57	106	949.5	21.6	1421.73	47.75	16.7	5.4	6340	269	80.51	30.28	3945	1726	8.38	1.645	YES
Magnesium	49	60	109	5564.48	11027.66	2700.2	6826.1	2540	2830	17300	34900	37.97	68.91	1861	4135	-5.08	1.645	NO
Manganese	49	50	99	526.59	555.46	185.81	321.54	221	207	996	2380	51.06	48.96	2502	2448	0.3639	1.645	NO
Mercury	49	56	105	0.11	0.05	0.19	0.07	0.015	0.005	1	0.5	69.96	38.16	3428	2137	5.36	1.645	YES
Nickel	49	60	109	27.04	30.83	9.08	10.89	14.1	12.3	50.8	62.3	48.89	59.99	2396	3599	-1.82	1.645	NO
Potassium	49	60	109	1394.61	1612.98	286.79	590.06	848	628	2260	3460	49.83	59.22	2442	3553	-1.54	1.645	NO
Selenium	49	57	106	0.68	0.39	0.5	0.44	0.09	0.045	1.7	2.1	65.15	43.48	3192	2478	3.61	1.645	YES
Silver	49	57	106	1.31	0.34	1.86	0.26	0.11	0.04	9	0.87	65.61	43.09	3215	2456	3.76	1.645	YES
Sodium	49	60	109	91.01	91.24	78.84	54.92	24.75	8.45	383	269	51.31	58.02	2514	3481	-1.1	1.645	NO
Thallium	49	60	109	0.45	0.27	0.39	0.23	0.085	0.075	1.5	1.2	61.96	49.32	3036	2959	2.07	1.645	YES
Vanadium	49	60	109	22.3	22.11	5.19	6.84	8.9	11.5	30.1	36.9	56.33	53.92	2760	3235	0.396	1.645	NO
Zinc	49	57	106	301.1	75.36	356.07	27.82	53.2	36.2	1530	219	73.43	36.37	3598	2073	6.18	1.645	YES

Table 7-2B
SEAD 17 RI
Inorganics Statistical Analyses
(Wilcoxon Ranked Sum Test)

All Soils Medium

Metals	Number of site samples n	Number of background samples m	Total samples N (m+n)	Mean n (ug/kg)	Mean m (ug/kg)	Stddev n (ug/kg)	Stddev m (ug/kg)	Min. n (ug/kg)	Min. m (ug/kg)	Max. n (ug/kg)	Max. m (ug/kg)	Mean Rank n	Mean Rank m	Wilcoxon Rank Sum n	Wilcoxon Rank Sum m	Zrs	Z(1-alpha)	Reject Null Hypothesis?
Aluminum	61	60	121	13263.93	13397.33	3215.14	4521.01	3790	5560	19300	21200	60.41	61.6	3685	3696	-0.1867	1.645	NO
Antimony	45	60	105	6.33	2.81	10.79	2.88	0.18	0.07	52	17.1	60.24	47.57	2711	2854	2.1113	1.645	YES
Arsenic	61	57	118	5.8	5.42	2.01	2.7	3.4	2.7	16.1	21.5	65.16	53.44	3975	3046	1.8615	1.645	YES
Barium	45	60	105	146.43	81.05	105.1	26.72	27.2	33.9	524	159	69.3	40.78	3119	2447	4.7498	1.645	YES
Beryllium	61	60	121	0.57	0.66	0.16	0.25	0.16	0.27	0.99	1.4	56.63	65.44	3454	3926	-1.382	1.645	NO
Cadmium	59	54	113	3.1	0.58	4.75	0.72	0.04	0.01	25.5	2.9	69.2	43.67	4083	2358	4.1391	1.645	YES
Calcium	61	60	121	39752.94	48899.83	56390.8	50547.15	2180	1370	229000	293000	54.98	67.12	3354	4027	-1.9026	1.645	NO
Chromium	61	60	121	19.87	20.41	4.15	6.42	9.3	10.3	27.9	35.8	60.34	61.67	3681	3700	-0.21	1.645	NO
Cobalt	61	60	121	10.03	11.09	3.22	4.27	4.7	5.2	21.9	29.1	56.86	65.21	3468	3913	-1.3091	1.645	NO
Copper	61	60	121	129.04	21.94	180.94	8.62	14.9	9.7	837	62.8	81.92	39.73	4997	2384	6.6153	1.645	YES
Cyanide	61	54	115	0.29	0.28	0.19	0.04	0	0.21	1.5	0.41	59.45	56.36	3626	3043	0.4964	1.645	NO
Iron	61	60	121	23035.73	24656.16	5369.48	7470.55	8020	8770	38700	42500	58.05	64	3541	3840	-0.9332	1.645	NO
Lead	60	57	117	688.94	21.6	1112.88	47.75	7.5	5.4	6270	269	83.07	33.67	4984	1919	7.8748	1.645	YES
Magnesium	61	60	121	5856.22	11027.66	3012.59	6826.1	2540	2830	18100	34900	45.12	77.14	2752	4628	-5.0208	1.645	NO
Manganese	61	50	111	532.9	555.46	208.19	324.54	221	207	1160	2380	56.6	55.27	3453	2764	0.2163	1.645	NO
Mercury	61	56	117	0.1	0.05	0.17	0.07	0.01	0.005	1	0.5	73.25	43.47	4468	2434	4.7708	1.645	YES
Nickel	61	60	121	27.51	30.83	8.64	10.89	14.1	12.3	50.8	62.3	56.17	65.91	3426	3955	-1.5268	1.645	NO
Potassium	61	60	121	1375.16	1612.98	301.23	590.06	628	628	2260	3460	55.05	67.05	3358	4023	-1.8821	1.645	NO
Selenium	61	57	118	0.61	0.39	0.52	0.44	0.07	0.045	1.7	2.1	67.79	50.63	4135	2886	2.7235	1.645	YES
Silver	61	57	118	1.15	0.34	1.69	0.26	0.11	0.04	9	0.87	71.66	46.49	4371	2650	3.9957	1.645	YES
Sodium	61	60	121	92.38	91.24	75.63	54.92	24.75	8.45	383	269	58.02	64.03	3539	3842	-0.9409	1.645	NO
Thallium	61	60	121	0.39	0.27	0.37	0.23	0.07	0.075	1.5	1.2	64.65	57.29	3944	3437	1.1538	1.645	NO
Vanadium	61	60	121	22.49	22.11	5.03	6.84	8.9	11.5	30.7	36.9	62.81	59.16	3831	3550	0.5729	1.645	NO
Zinc	61	57	118	257.8	75.36	330.74	27.82	53.2	36.2	1530	219	76.1	41.74	4642	2379	5.4528	1.645	YES

Table 7-2C
SEAD 17 RI
Inorganics Statistical Analyses
(Wilcoxon Ranked Sum Test)

Zero to Four Foot Soil Medium

Metals	Number of site samples n	Number of background samples m	Total samples N (m+n)	Mean n (ug/kg)	Mean m (ug/kg)	Stddev n (ug/kg)	Stddev m (ug/kg)	Min. n (ug/kg)	Min. m (ug/kg)	Max n (ug/kg)	Max. m (ug/kg)	Mean Rank n	Mean Rank m	Wilcoxon Rank Sum n	Wilcoxon Rank Sum m	Zrs	Z(1-alpha)	Reject Null Hypothesis?
Aluminum	60	60	120	13340	13397.33	3186.44	4521.01	3790	5560	19300	21200	60.21	60.79	3613	3647	-0.0919	1.645	NO
Antimony	44	60	104	6.37	2.81	10.91	2.88	0.185	0.07	52	17.1	59.57	47.32	2621	2839	2.0465	1.645	YES
Arsenic	60	57	117	5.84	5.42	2	2.7	3.5	2.7	16.1	21.5	65.12	52.56	3907	2996	2.0022	1.645	YES
Barium	44	60	104	148.41	81.05	105.47	26.72	27.2	33.9	524	159	69.52	40.02	3059	2401	4.9283	1.645	YES
Beryllium	60	60	120	0.58	0.66	0.1699	0.25	0.16	0.27	0.99	1.4	56.36	64.64	3382	3878	-1.3047	1.645	NO
Cadmium	58	54	112	3.15	0.58	4.78	0.72	0.04	0.01	25.5	2.9	68.89	43.19	3996	2332	4.1843	1.645	YES
Calcium	60	60	120	39202.16	48899.83	56700.98	50547.15	2180	1370	229000	293000	54.16	66.84	3250	4010	-1.9971	1.645	NO
Chromium	60	60	120	19.97	20.41	4.11	6.42	9.3	10.3	27.9	35.8	60.1	60.9	3606	3654	-0.126	1.645	NO
Cobalt	60	60	120	10.05	11.09	3.25	4.27	4.7	5.2	21.9	29.1	56.48	64.52	3389	3871	-1.2651	1.645	NO
Copper	60	60	120	130.86	21.94	181.9	8.62	14.9	9.7	837	62.8	81.82	39.18	4909	2351	6.7135	1.645	YES
Cyanide	60	54	114	0.3	0.28	0.18	0.04	0	0.21	1.5	0.41	59.42	55.36	3565	2989	0.656	1.645	NO
Iron	60	60	120	23106.33	24656.16	5386.17	7470.55	8020	8770	38700	42500	57.74	63.26	3464	3796	-0.8687	1.645	NO
Lead	59	57	116	700.49	21.6	1118.8	47.75	11.2	5.4	6270	269	83.32	32.81	4916	1870	8.0883	1.645	YES
Magnesium	60	60	120	5652.16	11027.66	2578.05	6826.1	2540	2830	17300	34900	44.03	76.97	2642	4618	-5.1857	1.645	NO
Manganese	60	50	110	535.26	555.46	209.12	324.54	221	207	1160	2380	56.37	54.46	3382	2723	0.3122	1.645	NO
Mercury	60	56	116	0.1	0.05	0.17	0.07	0.15	0.005	1	0.5	73.32	42.62	4399	2387	4.9427	1.645	YES
Nickel	60	60	120	27.55	30.83	8.71	10.89	14.1	12.3	50.8	62.3	55.75	65.25	3345	3915	-1.4959	1.645	NO
Potassium	60	60	120	1379.91	1612.98	301.45	590.06	628	628	2260	3460	54.79	66.21	3287	3973	-1.7979	1.645	NO
Selenium	60	57	117	0.62	0.39	0.52	0.44	0.08	0.045	1.7	2.1	67.83	49.7	4070	1539	2.8913	1.645	YES
Silver	60	57	117	1.16	0.34	1.71	0.26	0.115	0.04	9	0.87	71.12	46.25	4267	2636	3.9667	1.645	YES
Sodium	60	60	120	91.64	91.24	76.04	54.92	24.75	8.45	383	269	57.15	63.85	3429	3831	-1.055	1.645	NO
Thallium	60	60	120	0.4	0.27	0.37	0.23	0.08	0.075	1.5	1.2	64.7	56.3	3882	3378	1.3231	1.645	NO
Vanadium	60	60	120	22.64	22.11	4.94	6.84	8.9	11.5	30.7	36.9	62.68	58.32	3761	3499	0.6876	1.645	NO
Zinc	60	57	117	261.14	75.36	332.49	27.82	53.2	36.2	1530	219	76.13	40.97	4568	2335	5.603	1.645	YES

Table 7-2D
SEAD-17 Remedial Investigation
COMPARISON OF SITE GROUNDWATER DATA TO BACKGROUND GROUNDWATER DATA
SAMPLES WITH NTUs OF 50 OR LESS

Parameter	Number of Site Samples (n)	Number of Background Samples (m)	Total Samples (n+m)	Mean n (ug/L)	Mean m (ug/L)	Frequency of detection - SITE	Frequency of detection - BACKGROUND	Max. n (ug/L)	Max. m (ug/L)	mean rank n	mean rank m	Wilcoxon Rank Sum n	Wilcoxon Rank Sum n	Zrs	Z(1-alpha)	Reject Null Hypothesis?	Is the site mean greater than two times the background mean?
Aluminum	7	28	35	285.01	2,449.11	43%	86%	1070	42,400.00	12.79	19.3	89.53	540.4	-1.505	1.645	NO	NO
Antimony	7	28	35	8.1 U	8.87	0%	18%	na	44.70	21.21	17.2	148.47	481.6	na	1.645	na	na
Arsenic	7	27	34	1.67	1.52	14%	7%	0.87	9.30	21.79	16.39	152.53	442.53	na	1.645	na	NO
Barium	7	27	34	34.58	73.32	43%	93%	92.5	337.00	10.14	19.41	70.98	524.07	-2.194	1.645	NO	NO
Beryllium	7	26	33	0.15	0.21	14%	12%	0.23	2.20	20.21	16.13	141.47	419.38	na	1.645	na	NO
Cadmium	7	28	35	1 U	1 U	0%	0%	na	na	21.57	17.11	150.99	479.08	na	1.645	na	na
Calcium	7	28	35	104,300.00	122,403.17	100%	100%	118000	240,000.00	12.36	19.41	86.52	543.48	-1.630	1.645	NO	NO
Chromium	7	27	34	1.4 U	4.28	0%	44%	na	69.40	14.5	18.28	101.5	493.56	na	1.645	na	na
Cobalt	7	28	35	2.2 U	3.64	0%	43%	na	34.60	16.14	18.46	112.98	516.88	na	1.645	na	na
Copper	7	28	35	1.35	2.78	14%	46%	3.3	23.30	16.5	18.38	115.5	514.64	na	1.645	na	NO
Cyanide	7	27	34	5 U	5.4 U	0%	0%	na	na	17	17.63	119	476.01	na	1.645	na	na
Iron	7	28	35	492.79	3,918.51	71%	96%	1870	69,400.00	13	19.25	91	539	-1.440	1.645	NO	NO
Lead	7	27	34	1.03	2.65	29%	33%	1.9	34.80	19.79	16.91	138.53	456.57	na	1.645	na	NO
Magnesium	7	28	35	15,842.86	26,818.63	100%	100%	17800	57,600.00	10.64	19.84	74.48	555.52	-2.120	1.645	NO	NO
Manganese	7	28	35	135.12	193.74	86%	96%	550	1,120.00	15.86	18.54	111.02	519.12	-0.619	1.645	NO	NO
Mercury	7	26	33	0.05	0.04	14%	12%	0.07	0.05	23.36	15.29	163.52	397.54	na	1.645	na	NO
Nickel	7	28	35	1.63	6.75	14%	50%	2.4	99.80	16	18.5	112	518	na	1.645	na	NO
Potassium	7	27	34	2,452.71	3,321.86	57%	93%	5820	10,200.00	14.29	18.33	100.03	494.91	-0.959	1.645	NO	NO
Selenium	7	27	34	3.2 U	1.41	0%	15%	na	3.60	19.79	16.91	138.53	456.57	na	1.645	na	na
Silver	7	28	35	2.2 U	1.18	0%	4%	na	0.68	21.93	17.02	153.51	476.56	na	1.645	na	na
Sodium	7	28	35	22,152.86	19,364.92	100%	96%	46100	73,500.00	22.5	16.88	157.5	472.64	1.299	1.645	NO	NO
Thallium	7	27	34	2.55	1.71	14%	15%	4.7	5.70	21.79	16.39	152.53	442.53	na	1.645	na	NO
Vanadium	7	28	35	2.1 U	5.20	0%	43%	na	70.80	16.5	18.38	115.5	514.64	na	1.645	na	na
Zinc	6	25	31	17.25	25.43	50%	88%	63.9	143.00	15.75	16.06	94.5	401.5	-0.075	1.645	NO	NO

NOTES 1) na = The frequency of detection is too low to make a valid statistical comparison.

to two foot soil sample interval at this location were sufficiently elevated to justify considering the soil samples from this location as site samples and not background samples. It should be noted that the subsurface soil samples at this location have low concentrations of inorganic elements, and evidence of inorganic analytes leaching from the surface is not observed. This observation is the basis for keeping the groundwater samples from MW17-1 in the background database. The screened interval in MW17-1 is from 3.4 to 7.4 feet below ground surface, which is below the interval where inorganic elements were detected at elevated concentrations.

The analytical results of each pair of samples and duplicate samples were averaged to produce single sets of results used to calculate EPCs for each detected analyte. The following logic was used to average the results of samples and their duplicate samples:

- If an analyte was detected in both the sample and duplicate sample, then the detected values were averaged.
- If an analyte was not detected in either the sample or duplicate sample, then the sample quantitation limits (SQLs) were averaged.
- If an analyte was detected in only one sample of a sample-duplicate pair and the SQL of the other sample was less than four times the detected value, then the analyte was considered present at a level equal to the average of the detected value and one-half of the SQL.
- If an analyte was detected in only one sample of a sample-duplicate pair and the SQL of the other sample was greater than or equal to four times the detected value, then the analyte was considered present at the detected level.

The EPC, or the 95% UCL of the mean concentration, was calculated for each analyte using the following algorithm:

1. A list of concentrations was tabulated for each detected analyte using one-half of the SQL for all negative results.
2. Each analyte distribution was tested for normality by either the Shapiro-Wilk Test for less than or equal to 50 samples, or the D'Agostino Test for more than 50 samples (Gilbert, 1987, pp. 158-162). A normal distribution was assumed if the distribution passed the test at the 0.05 significance level, otherwise the distribution was assumed to be lognormal.
3. The 95 percent UCL of the mean was calculated using the t-statistic for normal distributions or the H-statistic for lognormal distributions (see Gilbert, 1987). If the 95 percent UCL of the mean exceeded the maximum detected concentration, then the following steps were executed.

4. The set of results was tested for unusually high SQLs. An unusually high SQL was assumed to exceed 1.5 times the average SQL.
5. If an unusually high SQL was present and the 95 percent UCL of the mean exceeded the maximum detected concentration, then the sample with the highest SQL was excluded from the data set and the statistics were re-calculated (1 through 4, above).
6. Analytical results with unusually high SQLs were removed one-by-one until either (a) the 95 percent UCL of the mean no longer exceeded the maximum detected concentration or (b) no more unusually high SQLs were present.
7. In cases where the final 95 percent UCL exceeded the maximum detected concentration, the maximum detected concentration was selected as the EPC. In these cases, the maximum detected concentration is believed to be a better conservative (upper bound) estimate of the mean than the established 95% UCL for various reasons, including small sample populations, small number of detected values, poor knowledge of the underlying statistical distribution based on available data, and variable SQLs.

Tables 7-3A to 7-3D list the chemicals of potential concern for the baseline human health and ecological risk assessments in all soils, surface soils (0 to 6 inches), surface water, and sediment, respectively. There were no organic analytes detected in the on-site groundwater samples, and no inorganic analytes were detected in the on-site groundwater samples at concentrations that were distinguishable from background. As there are no exposure point concentrations for the groundwater pathway, this pathway is incomplete, and therefore this exposure pathway was no longer considered in the baseline risk assessment. For each analyte detected in each sample medium, this tables present the number of analyses performed, the number of times detected, the frequency of detection, the mean and standard deviation of the sampled concentration, the maximum detected concentration, the result of the test for normality, and the 95 percent UCL of the mean of the sampled concentration (RME and the CT concentrations).

Table 7-4 provides a summary of all chemicals quantified in the human health risk assessment. This table lists the analytes found in each sampled medium, less the inorganic analytes found at background levels.

7.3 EXPOSURE ASSESSMENT

7.3.1 Overview and Characterization of Exposure Setting

The objective of the exposure assessment was to estimate the type and magnitude of exposures to the Chemicals of Potential Concern (COPC) that are present at, or migrating from, the site. This component of the risk assessment can be performed either qualitatively or quantitatively.

TABLE 7-3A

Surface Soil Exposure Point Concentration Summary

SEAD 17 - Remedial Investigation
Seneca Army Depot Activity

Analyte	No. of Valid Analyses	No. of ejected SQLs	No of Hits	Frequency (%)	Mean (mg/kg)	Standard Deviation (mg/kg)	Max Hit (mg/kg)	Normal?	95% UCL of Mean (mg/kg)	Exposure Point Concentration (EPC)* (mg/kg)
Volatile Organics										
Acetone	47	0	3	6%	7.10E-03	4.87E-03	1.08E-02	FALSE	7.52E-03	7.52E-03
Benzene	47	0	2	4%	5.93E-03	1.01E-03	2.00E-03	FALSE	6.36E-03	2.00E-03
Methylene chloride	47	0	1	2%	6.02E-03	6.75E-04	4.00E-03	FALSE	6.20E-03	4.00E-03
Toluene	47	0	5	11%	5.88E-03	1.24E-03	8.00E-03	FALSE	6.55E-03	6.55E-03
Semivolatile Organics										
2,4-Dinitrotoluene**	47	0	6	13%	2.54E-01	2.46E-01	1.40E+00	FALSE	2.91E-01	2.91E-01
2,6-Dinitrotoluene**	46	1	1	2%	1.94E-01	2.45E-02	7.00E-02	FALSE	2.03E-01	7.00E-02
2-Methylnaphthalene	46	1	2	4%	1.93E-01	3.07E-02	1.30E-01	FALSE	2.12E-01	1.30E-01
2-Methylphenol	46	1	1	2%	1.95E-01	1.95E-02	1.20E-01	FALSE	2.00E-01	1.20E-01
3,3`-Dichlorobenzidine	47	0	1	2%	2.21E-01	1.43E-01	4.10E-01	FALSE	2.32E-01	2.32E-01
3-Nitroaniline	47	0	1	2%	5.35E-01	3.41E-01	9.90E-01	FALSE	5.62E-01	5.62E-01
4-Nitroaniline	47	0	1	2%	5.35E-01	3.41E-01	9.90E-01	FALSE	5.62E-01	5.62E-01
Acenaphthene	46	1	2	4%	1.90E-01	3.87E-02	3.30E-02	FALSE	2.24E-01	3.30E-02
Acenaphthylene	46	1	2	4%	1.92E-01	3.18E-02	9.60E-02	FALSE	2.10E-01	9.60E-02
Anthracene	46	1	3	7%	1.90E-01	3.35E-02	1.30E-01	FALSE	2.13E-01	1.30E-01
Benzo[a]anthracene	47	0	18	38%	1.81E-01	1.91E-01	7.20E-01	FALSE	2.86E-01	2.86E-01
Benzo[a]pyrene	47	0	19	40%	1.85E-01	2.14E-01	9.40E-01	FALSE	2.91E-01	2.91E-01
Benzo[b]fluoranthene	47	0	18	38%	2.18E-01	3.43E-01	2.20E+00	FALSE	3.03E-01	3.03E-01
Benzo[ghi]perylene	47	0	15	32%	1.96E-01	1.85E-01	7.10E-01	FALSE	2.64E-01	2.64E-01
Benzo[k]fluoranthene	47	0	15	32%	1.79E-01	1.72E-01	5.30E-01	FALSE	2.67E-01	2.67E-01
Bis(2-Chloroisopropyl)ether	24	0	1	4%	2.01E-01	4.60E-02	4.10E-01	FALSE	2.13E-01	2.13E-01
Butylbenzylphthalate	46	1	2	4%	1.91E-01	3.56E-02	4.60E-02	FALSE	2.13E-01	4.60E-02
Carbazole	47	0	3	6%	2.17E-01	1.46E-01	4.10E-01	FALSE	2.37E-01	2.37E-01
Chrysene	47	0	28	60%	1.48E-01	1.98E-01	6.70E-01	FALSE	2.27E-01	2.27E-01
Di-n-butylphthalate	47	0	20	43%	2.21E-01	2.02E-01	1.20E+00	FALSE	2.84E-01	2.84E-01
Dibenz[a,h]anthracene	47	0	9	19%	2.01E-01	1.59E-01	4.70E-01	FALSE	2.55E-01	2.55E-01
Dibenzofuran	46	1	1	2%	1.94E-01	2.84E-02	3.60E-02	FALSE	2.10E-01	3.60E-02
Fluoranthene	47	0	33	70%	1.53E-01	2.33E-01	1.00E+00	FALSE	2.11E-01	2.11E-01
Fluorene	46	1	1	2%	1.94E-01	2.82E-02	3.80E-02	FALSE	2.09E-01	3.80E-02
Indeno[1,2,3-cd]pyrene	47	0	12	26%	2.06E-01	1.86E-01	7.90E-01	FALSE	2.77E-01	2.77E-01
N-Nitrosodiphenylamine	46	1	4	9%	1.86E-01	4.27E-02	9.50E-02	FALSE	2.13E-01	9.50E-02
Naphthalene	46	1	3	7%	1.87E-01	4.52E-02	3.70E-02	FALSE	2.30E-01	3.70E-02
Pentachlorophenol	47	0	2	4%	5.34E-01	3.51E-01	9.90E-01	FALSE	6.10E-01	6.10E-01
Phenanthrene	47	0	20	43%	1.66E-01	1.72E-01	3.60E-01	FALSE	2.55E-01	2.55E-01
Pyrene	47	0	32	68%	1.57E-01	2.41E-01	1.20E+00	FALSE	2.06E-01	2.06E-01
bis(2-Ethylhexyl)phthalate	47	0	11	23%	3.02E-01	2.72E-01	1.30E+00	FALSE	3.43E-01	3.43E-01
Pesticides/PCBs										
4,4'-DDD	47	0	4	9%	2.65E-03	2.94E-03	1.50E-02	FALSE	2.76E-03	2.76E-03
4,4'-DDE	47	0	20	43%	8.42E-03	2.10E-02	1.40E-01	FALSE	8.57E-03	8.57E-03
4,4'-DDT	47	0	10	21%	3.58E-03	3.91E-03	1.60E-02	FALSE	3.96E-03	3.96E-03
Aldrin	47	0	1	2%	1.21E-03	1.17E-03	1.90E-03	FALSE	1.25E-03	1.25E-03
Aroclor-1260	47	0	3	6%	2.34E-02	2.27E-02	2.80E-02	FALSE	2.42E-02	2.42E-02
Dieldrin	47	0	7	15%	6.28E-03	1.45E-02	8.00E-02	FALSE	6.01E-03	6.01E-03
Endosulfan I	47	0	5	11%	1.04E-02	6.26E-02	4.30E-01	FALSE	2.72E-03	2.72E-03
Endosulfan sulfate	47	0	1	2%	2.36E-03	2.63E-03	2.00E-02	FALSE	2.41E-03	2.41E-03
Endrin	47	0	3	6%	2.93E-03	6.00E-03	4.30E-02	FALSE	2.76E-03	2.76E-03
Endrin ketone	47	0	2	4%	3.51E-03	1.01E-02	7.10E-02	FALSE	2.93E-03	2.93E-03
Heptachlor epoxide	46	1	1	2%	1.02E-03	7.78E-05	1.10E-03	FALSE	1.05E-03	1.05E-03
alpha-Chlordane	46	1	1	2%	1.02E-03	7.80E-05	1.10E-03	FALSE	1.05E-03	1.05E-03
beta-BHC	47	0	1	2%	1.42E-03	2.77E-03	2.00E-02	FALSE	1.35E-03	1.35E-03
delta-BHC	47	0	1	2%	1.22E-03	1.18E-03	2.20E-03	FALSE	1.26E-03	1.26E-03
Nitroaromatics										
2,4-Dinitrotoluene**	47	0	4	9%	7.18E-02	4.27E-02	3.30E-01	FALSE	7.58E-02	7.58E-02
2,6-Dinitrotoluene**	47	0	1	2%	8.03E-02	1.22E-01	9.00E-01	FALSE	7.92E-02	7.92E-02
Metals										
Antimony	47	0	26	55%	6.65E+00	1.03E+01	5.20E+01	FALSE	1.15E+01	1.15E+01
Arsenic	47	0	47	100%	6.00E+00	2.13E+00	1.61E+01	FALSE	6.44E+00	6.44E+00
Barium	47	0	32	68%	1.41E+02	1.01E+02	5.24E+02	FALSE	1.67E+02	1.67E+02
Cadmium	47	0	42	89%	3.71E+00	4.98E+00	2.55E+01	FALSE	8.82E+00	8.82E+00
Copper	47	0	47	100%	1.51E+02	1.94E+02	8.37E+02	FALSE	2.21E+02	2.21E+02
Lead	47	0	46	98%	8.68E+02	1.23E+03	6.27E+03	FALSE	2.25E+03	2.25E+03
Mercury	47	0	45	96%	1.21E-01	1.96E-01	1.00E+00	FALSE	1.31E-01	1.31E-01
Selenium	47	0	35	75%	6.78E-01	4.93E-01	1.70E+00	FALSE	1.03E+00	1.03E+00
Silver	47	0	16	34%	1.28E+00	1.85E+00	9.00E+00	FALSE	2.06E+00	2.06E+00
Thallium	47	0	11	23%	4.59E-01	3.97E-01	1.50E+00	FALSE	6.38E-01	6.38E-01
Zinc	47	0	47	100%	2.81E+02	3.17E+02	1.48E+03	FALSE	3.57E+02	3.57E+02
Herbicides										
MCPA	23	0	4	17%	6.61E+00	8.93E+00	3.40E+01	FALSE	8.49E+00	8.49E+00

* Refer to text for a detailed discussion of EPC determination.

** 2,4-Dinitrotoluene and 2,6-Dinitrotoluene were analyzed for as semivolatile organics and nitroaromatics. The method yielding the higher EPC was used in the risk assessment.

TABLE 7-3B

Total Soils Exposure Point Concentration Summary

SEAD 17 - Remedial Investigation
Seneca Army Depot Activity

Analyte	No. of Valid Analyses	No. of ejected SQLs	No. of Hits	Frequency (%)	Mean (mg/kg)	Standard Deviation (mg/kg)	Max Hit (mg/kg)	Normal?	95% UCL of Mean (mg/kg)	Exposure Point Concentration (EPC)* (mg/kg)
Volatile Organics										
Acetone	56	0	3	5%	6.93E-03	4.48E-03	1.08E-02	FALSE	7.25E-03	7.25E-03
Benzene	56	0	2	4%	5.94E-03	9.31E-04	2.00E-03	FALSE	6.30E-03	2.00E-03
Methylene chloride	56	0	1	2%	6.02E-03	6.26E-04	4.00E-03	FALSE	6.17E-03	4.00E-03
Toluene	56	0	5	9%	5.91E-03	1.14E-03	8.00E-03	FALSE	6.46E-03	6.46E-03
Semivolatile Organics										
2,4-Dinitrotoluene**	56	0	6	11%	2.44E-01	2.26E-01	1.40E+00	FALSE	2.71E-01	2.71E-01
2,6-Dinitrotoluene**	55	1	1	2%	1.94E-01	2.27E-02	7.00E-02	FALSE	2.01E-01	7.00E-02
2-Methylnaphthalene	55	1	2	4%	1.93E-01	2.83E-02	1.30E-01	FALSE	2.09E-01	1.30E-01
2-Methylphenol	55	1	1	2%	1.94E-01	1.82E-02	1.20E-01	FALSE	1.99E-01	1.20E-01
3,3`-Dichlorobenzidine	56	0	1	2%	2.17E-01	1.31E-01	4.10E-01	FALSE	2.25E-01	2.25E-01
3-Nitroaniline	56	0	1	2%	5.24E-01	3.13E-01	9.90E-01	FALSE	5.45E-01	5.45E-01
4-Nitroaniline	56	0	1	2%	5.24E-01	3.13E-01	9.90E-01	FALSE	5.45E-01	5.45E-01
Acenaphthene	55	1	2	4%	1.90E-01	3.56E-02	3.30E-02	FALSE	2.18E-01	3.30E-02
Acenaphthylene	55	1	2	4%	1.92E-01	2.93E-02	9.60E-02	FALSE	2.07E-01	9.60E-02
Anthracene	55	1	3	6%	1.91E-01	3.08E-02	1.30E-01	FALSE	2.09E-01	1.30E-01
Benzo[a]anthracene	56	0	18	32%	1.83E-01	1.75E-01	7.20E-01	FALSE	2.70E-01	2.70E-01
Benzo[a]pyrene	56	0	19	34%	1.86E-01	1.95E-01	9.40E-01	FALSE	2.75E-01	2.75E-01
Benzo[b]fluoranthene	56	0	18	32%	2.14E-01	3.14E-01	2.20E+00	FALSE	2.81E-01	2.81E-01
Benzo[ghi]perylene	56	0	15	27%	1.96E-01	1.69E-01	7.10E-01	FALSE	2.50E-01	2.50E-01
Benzo[k]fluoranthene	56	0	15	27%	1.81E-01	1.57E-01	5.30E-01	FALSE	2.54E-01	2.54E-01
Bis(2-Chloroisopropyl)ether	24	0	1	4%	2.01E-01	4.60E-02	4.10E-01	FALSE	2.13E-01	2.13E-01
Butylbenzylphthalate	55	1	2	4%	1.91E-01	3.27E-02	4.60E-02	FALSE	2.09E-01	4.60E-02
Carbazole	56	0	3	5%	2.13E-01	1.34E-01	4.10E-01	FALSE	2.29E-01	2.29E-01
Chrysene	56	0	28	50%	1.55E-01	1.81E-01	6.70E-01	FALSE	2.33E-01	2.33E-01
Di-n-butylphthalate	56	0	20	36%	2.16E-01	1.85E-01	1.20E+00	FALSE	2.65E-01	2.65E-01
Dibenz[a,h]anthracene	56	0	9	16%	2.00E-01	1.45E-01	4.70E-01	FALSE	2.42E-01	2.42E-01
Dibenzofuran	55	1	1	2%	1.93E-01	2.62E-02	3.60E-02	FALSE	2.07E-01	3.60E-02
Fluoranthene	56	0	33	59%	1.59E-01	2.13E-01	1.00E+00	FALSE	2.20E-01	2.20E-01
Fluorene	55	1	1	2%	1.94E-01	2.60E-02	3.80E-02	FALSE	2.06E-01	3.80E-02
Indeno[1,2,3-cd]pyrene	56	0	12	21%	2.04E-01	1.71E-01	7.90E-01	FALSE	2.60E-01	2.60E-01
N-Nitrosodiphenylamine	55	1	4	7%	1.87E-01	3.92E-02	9.50E-02	FALSE	2.10E-01	9.50E-02
Naphthalene	55	1	3	6%	1.88E-01	4.14E-02	3.70E-02	FALSE	2.23E-01	3.70E-02
Pentachlorophenol	56	0	2	4%	5.23E-01	3.22E-01	9.90E-01	FALSE	5.83E-01	5.83E-01
Phenanthrene	56	0	20	36%	1.71E-01	1.57E-01	3.60E-01	FALSE	2.47E-01	2.47E-01
Pyrene	56	0	32	57%	1.62E-01	2.21E-01	1.20E+00	FALSE	2.14E-01	2.14E-01
bis(2-Ethylhexyl)phthalate	56	0	18	32%	2.75E-01	2.63E-01	1.30E+00	FALSE	3.44E-01	3.44E-01
Pesticides/PCBs										
4,4`-DDD	56	0	4	7%	2.54E-03	2.70E-03	1.50E-02	FALSE	2.61E-03	2.61E-03
4,4`-DDE	56	0	20	36%	7.38E-03	1.94E-02	1.40E-01	FALSE	6.91E-03	6.91E-03
4,4`-DDT	56	0	10	18%	3.31E-03	3.62E-03	1.60E-02	FALSE	3.55E-03	3.55E-03
Aldrin	56	0	1	2%	1.17E-03	1.07E-03	1.90E-03	FALSE	1.20E-03	1.20E-03
Aroclor-1254	56	0	1	2%	2.32E-02	2.14E-02	6.10E-02	FALSE	2.39E-02	2.39E-02
Aroclor-1260	56	0	3	5%	2.28E-02	2.08E-02	2.80E-02	FALSE	2.33E-02	2.33E-02
Dieldrin	56	0	7	13%	5.58E-03	1.33E-02	8.00E-02	FALSE	5.02E-03	5.02E-03
Endosulfan I	56	0	5	9%	8.90E-03	5.73E-02	4.30E-01	FALSE	2.29E-03	2.29E-03
Endosulfan sulfate	56	0	1	2%	2.29E-03	2.41E-03	2.00E-02	FALSE	2.32E-03	2.32E-03
Endrin	56	0	3	5%	2.77E-03	5.50E-03	4.30E-02	FALSE	2.60E-03	2.60E-03
Endrin ketone	56	0	2	4%	3.26E-03	9.23E-03	7.10E-02	FALSE	2.73E-03	2.73E-03
Heptachlor epoxide	55	1	1	2%	1.01E-03	7.63E-05	1.10E-03	TRUE	1.03E-03	1.03E-03
alpha-Chlordane	55	1	1	2%	1.02E-03	7.67E-05	1.10E-03	TRUE	1.03E-03	1.03E-03
beta-BHC	56	0	1	2%	1.35E-03	2.54E-03	2.00E-02	FALSE	1.28E-03	1.28E-03
delta-BHC	56	0	1	2%	1.18E-03	1.08E-03	2.20E-03	FALSE	1.21E-03	1.21E-03
Nitroaromatics										
2,4-Dinitrotoluene**	56	0	4	7%	7.07E-02	3.91E-02	3.30E-01	FALSE	7.39E-02	7.39E-02
2,6-Dinitrotoluene**	56	0	1	2%	7.79E-02	1.12E-01	9.00E-01	FALSE	7.66E-02	7.66E-02
Metals										
Antimony	56	0	26	46%	6.36E+00	9.50E+00	5.20E+01	FALSE	9.89E+00	9.89E+00
Arsenic	56	0	56	100%	5.84E+00	2.01E+00	1.61E+01	FALSE	6.21E+00	6.21E+00
Barium	56	0	41	73%	1.33E+02	9.46E+01	5.24E+02	FALSE	1.53E+02	1.53E+02
Cadmium	56	0	43	77%	3.21E+00	4.71E+00	2.55E+01	FALSE	6.61E+00	6.61E+00
Copper	56	0	56	100%	1.32E+02	1.83E+02	8.37E+02	FALSE	1.76E+02	1.76E+02
Lead	56	0	55	98%	7.47E+02	1.16E+03	6.27E+03	FALSE	2.46E+03	2.46E+03
Mercury	56	0	51	91%	1.08E-01	1.82E-01	1.00E+00	FALSE	1.15E-01	1.15E-01
Selenium	56	0	35	63%	5.86E-01	4.98E-01	1.70E+00	TRUE	6.98E-01	6.98E-01
Silver	56	0	16	29%	1.17E+00	1.71E+00	9.00E+00	FALSE	1.65E+00	1.65E+00
Thallium	56	0	11	20%	4.04E-01	3.84E-01	1.50E+00	FALSE	5.30E-01	5.30E-01
Zinc	56	0	56	100%	2.50E+02	2.99E+02	1.48E+03	FALSE	3.01E+02	3.01E+02
Herbicides										
MCPA	32	0	4	13%	5.57E+00	7.71E+00	3.40E+01	FALSE	6.26E+00	6.26E+00

* Refer to text for a detailed discussion of EPC determination.

** 2.4-Dinitrotoluene and 2,6-Dinitrotoluene were analyzed for as semivolatile organics and nitroaromatics. The method yielding the higher EPC was used in the risk assessment.

TABLE 7-3C

Surface Water Exposure Point Concentration Summary

SEAD 17 - Remedial Investigation
Seneca Army Depot Activity

Analyte	No. of Valid Analyses	No. of Rejected SQLs	No. of Hits	Frequency (%)	Mean (mg/L)	Standard Deviation (mg/L)	Max Hit (mg/L)	Normal?	95% UCL of Mean (mg/L)	Exposure Point Concentration (EPC)* (mg/L)
Semivolatile Organics										
Bis(2-Ethylhexyl)phthalate	10	0	2	20%	4.30E-03	1.49E-03	2.00E-03	FALSE	6.96E-03	2.00E-03
Metals										
Antimony	10	0	4	40%	5.17E-03	7.46E-03	2.36E-02	FALSE	2.21E-02	2.21E-02
Arsenic	10	0	6	60%	2.78E-03	1.31E-03	4.60E-03	FALSE	4.26E-03	4.26E-03
Barium	10	0	10	100%	4.70E-02	2.73E-02	1.00E-01	FALSE	7.22E-02	7.22E-02
Cadmium	10	0	5	50%	3.91E-04	3.63E-04	1.30E-03	FALSE	7.82E-04	7.82E-04
Calcium	10	0	10	100%	5.36E+01	1.66E+01	7.35E+01	TRUE	6.32E+01	6.32E+01
Chromium	10	0	1	10%	5.50E-04	1.58E-04	1.00E-03	FALSE	6.31E-04	6.31E-04
Copper	10	0	10	100%	1.30E-02	8.08E-03	3.27E-02	FALSE	1.93E-02	1.93E-02
Iron	10	0	10	100%	1.46E-01	8.21E-02	3.22E-01	TRUE	1.93E-01	1.93E-01
Lead	10	0	6	60%	7.21E-03	1.15E-02	3.71E-02	FALSE	4.42E-02	3.71E-02
Magnesium	10	0	10	100%	5.90E+00	2.88E+00	9.28E+00	FALSE	8.90E+00	8.90E+00
Manganese	10	0	10	100%	8.43E-03	6.20E-03	1.96E-02	TRUE	1.20E-02	1.20E-02
Nickel	10	0	1	10%	8.90E-04	2.85E-04	1.70E-03	FALSE	1.03E-03	1.03E-03
Potassium	10	0	10	100%	3.01E+00	8.97E-01	4.38E+00	TRUE	3.52E+00	3.52E+00
Selenium	10	0	5	50%	2.17E-03	1.06E-03	3.50E-03	FALSE	3.23E-03	3.23E-03
Sodium	10	0	10	100%	5.21E+00	3.18E+00	9.46E+00	TRUE	7.03E+00	7.03E+00
Vanadium	10	0	1	10%	7.20E-04	3.79E-04	1.80E-03	FALSE	9.00E-04	9.00E-04
Zinc	10	0	10	100%	2.41E-02	2.12E-02	6.17E-02	TRUE	3.63E-02	3.63E-02

* Refer to text for detailed discussion of EPC determination.

TABLE 7-3D

Sediment Exposure Point Concentration Summary

SEAD 17 - Remedial Investigation
Seneca Army Depot Activity

Analyte	No. of Valid Analyses	No. of Rejected SQLs	No. of Hits	Frequency (%)	Mean (mg/kg)	Standard Deviation (mg/kg)	Max Hit (mg/kg)	Normal?	95% UCL of Mean (mg/kg)	Exposure Point Concentration (EPC)* (mg/kg)
Volatile Organics										
Acetone	10	0	3	30%	1.06E-02	6.03E-03	2.60E-02	FALSE	1.44E-02	1.44E-02
Toluene	10	0	1	10%	7.60E-03	1.33E-03	8.00E-03	FALSE	8.40E-03	8.00E-03
Semivolatile										
2,4-Dimethylphenol	10	0	1	10%	2.35E-01	7.63E-02	3.20E-02	FALSE	4.51E-01	3.20E-02
2,4-Dinitrotoluene	10	0	1	10%	2.75E-01	6.77E-02	4.50E-01	FALSE	3.14E-01	3.14E-01
Benzo[a]anthracene	10	0	1	10%	2.33E-01	7.82E-02	2.50E-02	FALSE	5.05E-01	2.50E-02
Benzo[a]pyrene	10	0	1	10%	2.33E-01	7.67E-02	3.00E-02	FALSE	4.59E-01	3.00E-02
Benzo[b]fluoranthene	10	0	1	10%	2.34E-01	7.29E-02	4.30E-02	FALSE	3.91E-01	4.30E-02
Benzo[ghi]perylene	10	0	1	10%	2.33E-01	7.65E-02	3.10E-02	FALSE	4.52E-01	3.10E-02
Benzo[k]fluoranthene	10	0	1	10%	2.33E-01	7.59E-02	3.30E-02	FALSE	4.39E-01	3.30E-02
Bis(2-Ethylhexyl)phthalate	10	0	3	30%	1.93E-01	9.77E-02	7.70E-02	FALSE	4.24E-01	7.70E-02
Chrysene	10	0	1	10%	2.35E-01	7.15E-02	4.80E-02	FALSE	3.74E-01	4.80E-02
Fluoranthene	10	0	2	20%	2.19E-01	9.12E-02	7.00E-02	FALSE	4.45E-01	7.00E-02
Indeno[1,2,3-cd]pyrene	10	0	1	10%	2.32E-01	7.85E-02	2.40E-02	FALSE	5.16E-01	2.40E-02
Phenanthrene	10	0	1	10%	2.34E-01	7.53E-02	3.50E-02	FALSE	4.27E-01	3.50E-02
Pyrene	10	0	2	20%	2.16E-01	9.77E-02	4.70E-02	FALSE	5.67E-01	4.70E-02
Pesticides/PCBs										
4,4'-DDD	10	0	3	30%	4.08E-03	3.56E-03	1.30E-02	FALSE	6.46E-03	6.46E-03
4,4'-DDE	10	0	6	60%	1.25E-02	1.92E-02	6.20E-02	FALSE	4.82E-02	4.82E-02
4,4'-DDT	10	0	2	20%	3.49E-03	3.01E-03	1.20E-02	FALSE	4.90E-03	4.90E-03
Dieldrin	10	0	1	10%	2.81E-03	8.14E-04	5.00E-03	FALSE	3.26E-03	3.26E-03
Endosulfan I	10	0	1	10%	1.33E-03	1.70E-04	1.60E-03	TRUE	1.43E-03	1.43E-03
Endosulfan II	10	0	2	20%	2.69E-03	5.92E-04	3.80E-03	FALSE	3.05E-03	3.05E-03
Metals										
Aluminum	10	0	10	100%	1.64E+04	3.29E+03	2.21E+04	TRUE	1.83E+04	1.83E+04
Antimony	10	0	4	40%	1.64E+00	1.92E+00	5.50E+00	FALSE	5.59E+00	5.50E+00
Arsenic	10	0	10	100%	5.29E+00	1.41E+00	7.50E+00	TRUE	6.10E+00	6.10E+00
Barium	10	0	10	100%	1.12E+02	3.45E+01	1.62E+02	TRUE	1.32E+02	1.32E+02
Beryllium	10	0	10	100%	6.42E-01	2.13E-01	9.90E-01	TRUE	7.64E-01	7.64E-01
Cadmium	10	0	10	100%	1.57E+00	1.45E+00	4.80E+00	TRUE	2.40E+00	2.40E+00
Calcium	10	0	10	100%	6.03E+03	6.85E+03	2.50E+04	FALSE	1.08E+04	1.08E+04
Chromium	10	0	10	100%	2.22E+01	4.37E+00	2.77E+01	TRUE	2.47E+01	2.47E+01
Cobalt	10	0	10	100%	1.08E+01	3.04E+00	1.78E+01	TRUE	1.26E+01	1.26E+01
Copper	10	0	10	100%	7.33E+01	8.59E+01	3.09E+02	FALSE	1.33E+02	1.33E+02
Iron	10	0	10	100%	2.65E+04	5.05E+03	3.50E+04	TRUE	2.94E+04	2.94E+04
Lead	10	0	10	100%	2.70E+02	3.30E+02	1.05E+03	FALSE	6.83E+02	6.83E+02
Magnesium	10	0	10	100%	4.89E+03	1.13E+03	6.49E+03	TRUE	5.54E+03	5.54E+03
Manganese	10	0	10	100%	4.45E+02	1.52E+02	7.68E+02	TRUE	5.32E+02	5.32E+02
Mercury	10	0	4	40%	4.30E-02	4.44E-02	1.60E-01	FALSE	8.11E-02	8.11E-02
Nickel	10	0	10	100%	2.72E+01	6.37E+00	3.16E+01	FALSE	3.43E+01	3.16E+01
Potassium	10	0	10	100%	1.90E+03	4.99E+02	2.63E+03	TRUE	2.18E+03	2.18E+03
Selenium	10	0	3	30%	8.53E-01	5.07E-01	1.90E+00	FALSE	1.27E+00	1.27E+00
Sodium	10	0	8	80%	1.81E+02	1.61E+02	4.52E+02	FALSE	4.27E+02	4.27E+02
Thallium	10	0	2	20%	6.59E-01	2.88E-01	1.30E+00	TRUE	8.24E-01	8.24E-01
Vanadium	10	0	10	100%	2.68E+01	5.20E+00	3.38E+01	TRUE	2.97E+01	2.97E+01
Zinc	10	0	10	100%	1.30E+02	7.36E+01	2.78E+02	FALSE	1.88E+02	1.88E+02

* Refer to text for detailed discussion of EPC determination.

TABLE 7-4

List of Chemicals by Media Quantified in the Human Health Risk Assessment

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Analyte	Ambient Air	Surface Soils	Total Soils	Zero to 4ft Soils	Surface Water	Sediment
Volatile Organics						
Acetone	x	x	x	x		x
Benzene	x	x	x	x		
Methylene Chloride	x	x	x	x		
Toluene	x	x	x	x		x
Semivolatile Organics						
Dimethylphenol, 2,4-						x
Dinitrotoluene, 2,4-	x	x	x	x		x
Dinitrotoluene, 2,6-	x	x	x	x		
Methylnaphthalene, 2-	x	x	x	x		
Methylphenol, 2-	x	x	x	x		
Dichlorobenzidine, 3,3'-	x	x	x	x		
Nitroaniline, 3-	x	x	x	x		
Nitroaniline, 4-	x	x	x	x		
Acenaphthene	x	x	x	x		
Acenaphthylene	x	x	x	x		
Anthracene	x	x	x	x		
Benzo(a)anthracene	x	x	x	x		x
Benzo(a)pyrene	x	x	x	x		x
Benzo(b)fluoranthene	x	x	x	x		x
Benzo(g,h,i)perylene	x	x	x	x		x
Benzo(k)fluoranthene	x	x	x	x		x
Butylbenzylphthalate	x	x	x	x		
Carbazole	x	x	x	x		
Chrysene	x	x	x	x		x
Di-n-butylphthalate	x	x	x	x		
Dibenz(a,h)anthracene	x	x	x	x		
Dibenzofuran	x	x	x	x		
Fluoranthene	x	x	x	x		x
Fluorene	x	x	x	x		
Indeno(1,2,3-cd)pyrene	x	x	x	x		x
N-Nitroso-di-n-propylamine	x	x	x	x		
Naphthalene	x	x	x	x		
Pentachlorophenol	x	x	x	x		
Phenanthrene	x	x	x	x		x
Pyrene	x	x	x	x		x
bis(2-Chloroisopropyl) ether	x	x	x	x		
bis(2-Ethylhexyl)phthalate	x	x	x	x	x	x

TABLE 7-4

List of Chemicals by Media Quantified in the Human Health Risk Assessment

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Analyte	Ambient Air	Surface Soils	Total Soils	Zero to 4ft Soils	Surface Water	Sediment
Pesticides/PCBs						
DDD, 4,4'-	x	x	x	x		x
DDE, 4,4'-	x	x	x	x		x
DDT, 4,4'-	x	x	x	x		x
Aldrin	x	x	x	x		
Aroclor-1254						
Aroclor-1260	x	x	x	x		
Dieldrin	x	x	x	x		x
Endosulfan I	x	x	x	x		x
Endosulfan II						x
Endosulfan sulfate	x	x	x	x		
Endrin	x	x	x	x		
Endrin ketone	x	x	x	x		
Heptachlor epoxide	x	x	x	x		
alpha-Chlordane	x	x	x	x		
beta-BHC	x	x	x	x		
delta-BHC	x	x	x	x		
Nitroaromatics						
2,4-Dinitrotoluene	x	x	x	x		
2,6-Dinitrotoluene	x	x	x	x		
Metals						
Aluminum						x
Antimony			x	x	x	x
Arsenic	x	x	x	x	x	x
Barium	x	x	x	x	x	x
Beryllium						x
Cadmium	x	x	x	x	x	x
Calcium					x	x
Chromium					x	x
Cobalt						x
Copper	x	x	x	x	x	x
Iron					x	x
Lead	x	x	x	x	x	x
Magnesium					x	x
Manganese					x	x
Mercury	x	x	x	x		x
Nickel					x	x
Potassium					x	x
Selenium	x	x	x	x	x	x
Silver	x	x	x	x		
Sodium					x	x
Thallium	x	x				x
Vanadium					x	x
Zinc	x	x	x	x	x	x
Herbicides						
MCPA	x	x	x	x		

Quantitative assessment is preferred when toxicity factors necessary to characterize a compound of concern are available.

The exposure assessment consists of three steps (USEPA, 1989a):

1). **Characterize Exposure Setting:** Contained within this step is general information concerning the physical characteristics of the site as it pertains to potential considerations affecting exposure. The physical setting involves climate, vegetation, soil characteristics, surface and groundwater hydrology. All potentially exposed populations and subpopulations therein (receptors) are assessed relative to their potential for exposure. Additionally, locations relative to the site along with the current and potential future land use of the site are considered. This step is a qualitative one aimed at providing a general site perspective and offering insight on the surrounding population.

2). **Identify Exposure Pathways:** All exposure pathways, ways in which receptors can be exposed to contaminants that originate from the source, are reviewed in this step. Chemical sources and mechanisms for release along with subsequent fate and transport are investigated. Exposure points of human contact and exposure routes are discussed before quantifying the exposure pathways in step 3.

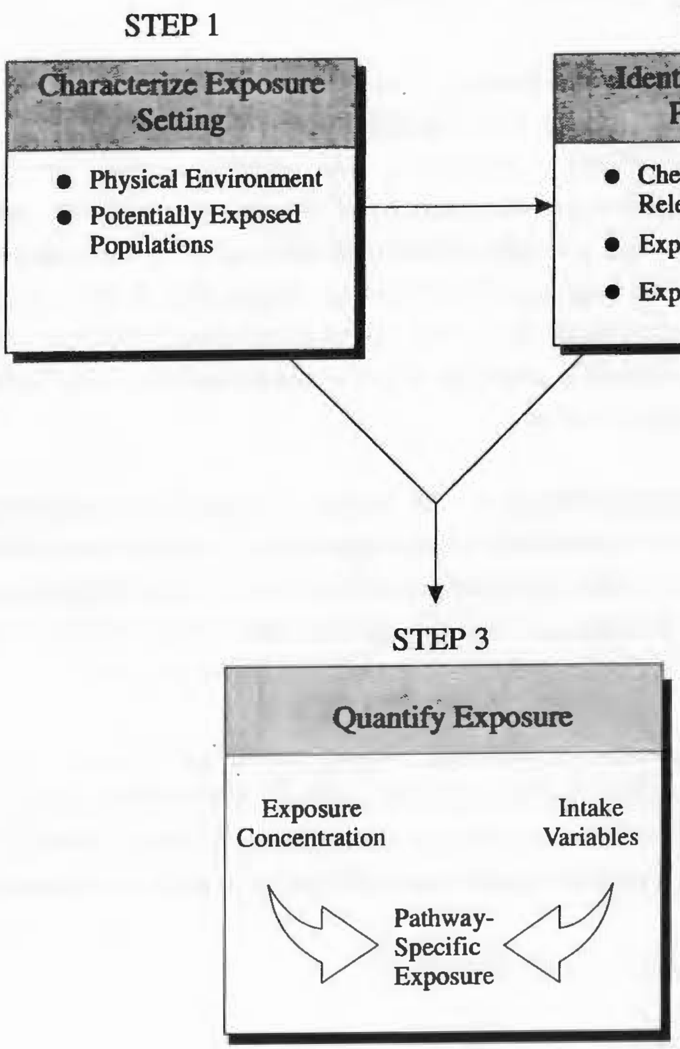
3). **Quantify Exposure:** In this final process, the exposure levels (COPC intakes or doses) are calculated for each exposure pathway and receptor. These calculations typically follow EPA guidance for assumptions of intake variables or exposure factors for each exposure pathway and EPA-recommended calculation methods.

Figure 7-2 illustrates the exposure assessment process.

7.3.2 Physical Setting

SEDA lies on the western side of a series of north to south trending rock terraces which separate Cayuga Lake on the east and Seneca Lake on the west. The rock terraces range in elevation from 490 feet above MSL in northern Seneca County to as much as 1,600 feet above MSL at the southern end of the lakes. Elevations on SEDA range from 450 feet above MSL on the western boundary to 760 feet above MSL in the southeast corner. The Depot's land surface generally slopes to the west and north.

Land use is divided into three categories on SEDA. The Main Post accounts for 9,832 acres and consists of an exclusion area containing partially buried, reinforced concrete igloos, general



Source: USEPA, 1989a

PARSONS
PARSONS ENGINEERING SCIENCE, INC.

CLIENT/PROJECT TITLE
SENECA ARMY DEPOT ACTIVITY
RI/FS
SEAD-17 ACTIVE DEACTIVATION FURNACE

DEPT ENVIRONMENTAL ENGINEERING
DWG NO. 729895-01001

FIGURE7-2
EXPOSURE ASSESSMENT PROCESS

SCALE NA
DATE JANUARY 1997

R:\GRAPHICS\SENECA\17EPA.CDR

storage magazines, and warehouses. The containment areas of the facility consist of the North and South Posts. The South Post is located in the southwest portion of the facility near Rte. 96 and is a developed area containing warehouses, administration buildings, quarters, and community services. The North Post, at the north end of the Main Post, includes troop housing, troop support and community services.

SEAD-17, the Existing Deactivation Furnace Building (Building 367), is located in the Ammo Area in the east-central portion of SEDA approximately 800 feet southwest of SEAD-16. It is located approximately 500 feet west of the chain link fence that defines the outer limits of the Ammo Area at SEDA. SEAD-17 is characterized by an elongated deactivation furnace building, surrounded by a crushed shale road. Beyond the crushed shale road is grassland. Two small sheds are located in the eastern portion of the site. There is vehicular access to the site within SEDA from an unpaved road to the north. Both vehicular and pedestrian access to the site is restricted because the site is located in the ammunition storage area.

7.3.2.1 Climate

A cool climate exists in the locality of SEDA with temperatures ranging from an average of 23°F in January to 69°F in July. Marked temperature differences are found between daytime highs and nighttime lows during the summer and portions of the transitional seasons. Precipitation is well-distributed, averaging approximately 3 inches per month. The annual average snowfall is approximately 100 inches. Wind velocities are moderate, but during the winter months, there are numerous days with sufficient winds to cause blowing and drifting snow. Daily precipitation data measured at the Aurora Research Farm in Aurora, New York for the period (1957-1991) were obtained from the Northeast Regional Climate Center at Cornell University. The maximum 24-hour precipitation measured at this station during this period was 3.91 inches on September 26, 1975. Values of 35 inches mean annual pan evaporation and 28 inches for annual lake evaporation were reported. An independent value of 27 inches for mean annual evaporation from open water surfaces was estimated from an isoplethic figure found in "*Water Atlas of the United States*" (Water Information Center, 1973).

SEDA is located in the Genessee-Finger Lakes Air Quality Control Region (AQCR). The AQCR is designated as non-attainment for ozone and attainment or unclassified for all other criteria pollutants. Data for existing air quality in the immediate area surrounding SEDA, however, can not be obtained since the nearest state air quality stations are 40 to 50 miles away from the army depot.

7.3.2.2 Vegetation

The vegetative communities within the 0.5-mile study area are predominantly upland cover types unevenly distributed among the developed areas of the South Post. Cover types include mown lawns, old fields, shrublands, and deciduous forest. Unvegetated areas consist of open storage lots, railroads, paved roads, and buildings. Unvegetated corridors are maintained by herbicide application along the railroad tracks adjacent to the site.

On-site vegetation is sparse. Only a few specimens of common weeds have been able to establish root systems in the compacted fill soils at the site. No shrub or tree strata are present. Vegetation consists of grasses and early successional herbaceous species, primarily spotted knapweed (*Centaurea maculosa*), orchard grass (*Dactylis glomerata*), and various other grasses. These species occupy approximately 5 percent of the ground surface of the site.

The types and distribution of vegetative communities surrounding the site result from decades of human modification of the environment of South Post and the ammunition area (Main Post) (SEDA, 1992a, c). Mowing, drainage diversion, building construction, landscaping practices, forestry practices, plantations, and herbicide application all control the composition of vegetation surrounding the site.

A detailed discussion of the Vegetative Cover can be found in section 3.2.7.2.3 of the RI report.

7.3.2.3 Geologic Setting and Soil Classification

The site geology at SEAD-17 is characterized by gray Devonian shale with a thin weathered zone where it contacts the overlying mantle of Pleistocene till. This stratigraphy is consistent over the entire site. Artificial fill consisting of crushed shale occurs above the till at locations surrounding the deactivation furnace building and near the above ground fuel oil and propane tanks.

The predominant surficial geologic unit present at SEAD-17 is dense till. It ranges in thickness from 2.3 feet to 6.0 feet and has an average of 3.7 feet. It is light brown and composed of silt and clay, some fine sand and some black shale fragments (up to 0.25 inches in diameter). The general Unified Soil Classification System description of the till on-site is as follows: Clay-silt, brown to olive gray, slightly plastic, small percentage of fine to medium sand, small percentage of fine to coarse gravel-sized gray shale clasts, dense and mostly dry in place, till, (ML).

A zone of gray weathered shale of variable thickness was encountered below the till at all of the locations drilled on-site. This zone is characterized by fissile shale with a large amount of brown interstitial silt and clay. The thickness of the weathered shale is between 0.5 feet and 3.3 feet thick on site. The average thickness is 2.0 feet. Gray competent shale was encountered between 4.0 and 8.5 feet below the land surface in the borings performed on the site.

A detailed discussion of the Site Geology is provided in section 3.2.4 of the RI report.

7.3.2.4 Surface Water

Surface water flow from precipitation events is controlled by local topography. Most of the surface water in the immediate vicinity of the furnace building flows off of the crushed shale roadway surrounding it onto lower grassland. A drainage swale traverses the eastern and southern portions of the site and transports surface water to the west. This swale intersects a well-defined south-draining swale that is defined by a elongate stand of low brush and trees; this eventually empties into Kendaia Creek. In the extreme northern portion of the site, surface water flows in a small swale drains to the north and west. The regional overland surface water flow is believed to be controlled by the overall westward sloping ground surface. There are no sustained surface water bodies on-site and flow in the drainage ditches is believed to be ephemeral.

7.3.2.5 Groundwater Hydrology

The hydrogeologic properties of the site were characterized in accordance with the investigation programs described in Section 2.0. Several groundwater topography maps were constructed for SEAD-17 using depth to water table measurements in the till/weathered shale aquifer.

The groundwater flow direction in the till/weathered shale aquifer on the site is to the southwest based on the groundwater elevations measured in four monitoring wells on April 4, 1994. The groundwater contour map for the August 29, 1996 data set also shows a southwesterly flow direction for groundwater. Groundwater elevations range from a high of 728.69 feet in the northeastern portion of the site to a low of 725.01 feet in the southwestern portion of the site. The horizontal groundwater gradient was calculated to be 0.01 ft/ft. The saturated thickness of the aquifer is generally was between 1.7 and 3.7 feet, however, at the location of the local bedrock high it was less than 0.1 feet. This indicates that the flow of groundwater at the site is likely to be locally influenced by bedrock topography.

For comparison purposes, a second groundwater contour map was constructed based on depth to water measurements made on December 6, 1996. This map shows a similar direction of flow (to the southwest), however, the saturated thickness of the till/weathered shale aquifer is greater. The groundwater data indicate that the flow directions and gradients are constant throughout the year at SEAD-17, and are not significantly impacted by changes in saturated thickness.

The calculated average linear velocity was found to be 1.0 ft/day (or 365 ft/year) at 20 percent effective porosity, and 1.3 ft/day (or 474.5 ft/year) at 15 percent effective porosity. It is likely that at certain times of the year, the saturated thickness of the aquifer will be small at SEAD-17 and the groundwater velocity may vary throughout the year. Thus, the calculated groundwater velocities may not be sustained throughout the year. Consequently, the actual annual distance of groundwater flow as indicated by the calculated velocities is likely to be significantly lower.

There is no current use of groundwater at SEAD-17. The future land use for this area has been designated commercial/industrial, so there is not future potential for residential use of groundwater as a drinking water source at SEAD-17. The analysis in Section 7.2.3 of chemicals in groundwater showed that groundwater beneath SEAD-17 has only background concentrations of the chemicals detected. Therefore, the site activities have not measurably impacted the groundwater and groundwater is not considered a potential current or future pathway of exposure.

7.3.3 Land Use and Potentially Exposed Populations

7.3.3.1 Current Land Use

The Existing Deactivation Furnace is no longer active and *is in a centralized area of SEDA.* Offsite residents are not considered to be potential receptors due to the distances between the location of the offsite residences and SEAD-17. There are no drinking water supply wells at SEAD-17.

This site has no actual site workers but is occasionally patrolled by site security personnel. As a result, it is unrealistic to assume that the workers from nearby sites will spend a significant amount of time on this site, and the most reasonable current on-site receptor was considered to be an infrequent Site Worker. The rationale of this decision is based on the site location relative to the majority of current site activity. The potential exposures occurring during onsite work have been evaluated in the risk assessment.

7.3.3.2 Potential Future Land Use

EPA guidance for determining future land uses recommends that, if available, master plans, which include future land uses, Bureau of Census projections and established land use trends in the general area should be utilized to establish future land use trends.

In July 1995, the Base Realignment and Closure Act (BRAC) Commission voted to recommend closure of SEDA. Congress approved the recommendation, which became public law on October 1, 1995. According to BRAC regulations, future uses of the site will be determined by the Army.

In accordance with BRAC regulations, the Army will notify all appropriate regulatory agencies and will perform any additional investigations and remedial actions to assure that any changes in the intended use of the sites is protective of human health and the environment in accordance with CERCLA. Also, Army regulations (Regulation 200-1, paragraph 12-5, Real Property Transactions), requires that Army to perform an Environmental Baseline Study (EBS) prior to a transfer of Army property. The EBS is an inventory and a comprehensive evaluation of the existing environmental conditions and consists of scope definition, survey, sampling, investigative and risk assessment.

As part of the 1995 Base Realignment and Closure (BRAC) process, a Land Redevelopment Authority comprised of representatives of the local public, was established. This group commissioned a study to recommend future uses for the Seneca Army Depot. The Land Reuse Plan which was produced designated various uses for different parcels of SEDA ranging from conservation/recreation to institutional, industrial and residential. The area which contains SEAD 17 was designated "Office/Planned Industrial Development".

In this human health assessment, the future land use of SEAD 17 was considered to be industrial/commercial. Although the risk due to future land uses will be calculated in this BRA, the decision to perform a remedial action will be based upon the anticipated future land use. At such time that the property is intended to be transferred in accordance with CERCLA, the Army will notify all appropriate regulatory agencies and will perform any additional investigations and remedial actions to assure that the change in the intended land use is protective of human health and the environment.

7.3.3.3 Potentially Exposed Populations

For purposes of this baseline risk assessment, six types of potentially exposed populations were considered. Under the current land-use scenario, there is one single exposed population: site workers. The future land-use scenario assumes that SEAD 17 is used by a new industrial or commercial business. In this scenario, there are five (5) exposed populations:

1) Industrial workers;
2) Construction workers who work for a short term onsite; and
3) A trespasser, presumed to be an adolescent age 13 to 18, who occasionally visits the property near the new commercial development.

4) Children who attend an on-site day care center (not located in the existing building); and
5) Adult workers at an on-site day care center.

The industrial worker is assumed to work 40 hours/week, 50 weeks a year at the new facility. The reasonable maximum exposure (RME) for the worker is based on 25 years of continuous employment at the site. The more typical or central tendency exposure (CT) is based on 7 years of employment.

The construction worker is assumed to work at the site for one year for both the RME and CT cases. The child trespasser is assumed to occasionally visit the site over 5 years for the RME and for just one year for the CT.

The day care center child is assumed to attend the center for six years, 60 hours/week (5 days/week, 12 hours/day) for 50 weeks a year under the RME scenario. The CT exposure is based on 10 hour days, 48 weeks/year for 3 years.

7.3.4 Identification of Exposure Pathways

Exposures are estimated only for plausible completed exposure pathways. A completed exposure pathway has the following four elements:

- a source and mechanism for chemical release,
- an environmental transport medium,
- an exposure point, and
- a human receptor and a feasible route of exposure at the exposure point.

A pathway cannot be completed unless each of these elements is present. The sources and mechanisms for release of chemicals and the environmental transport mediums are described in Section 5, Contaminant Fate and Transport.

7.3.4.1 Sources and Receiving Media

The contaminant source areas for this assessment of SEAD 17 consist of the Existing Deactivation Furnace Building and the remaining area as defined by the SEAD boundaries. As discussed previously, these are areas where activities occurred in the past and where RI data have shown elevated levels of chemicals in the environment. As evidenced by the RI data, these source areas have since spread to include contaminated surface and subsurface soil, surface water and sediment. Surface soil in SEAD 17 appears to be the most significant source area, as shown by the data.

7.3.4.2 Fate and Transport

The environmental fate associated with COPCs found at SEAD 17 is discussed in detail in Section 5. Air dispersion and deposition of COPCs were the principal transport mechanisms resulting in current conditions at the site.

7.3.4.2.1 Volatile Organics

A relatively small number of volatile organic compounds (VOCs) were detected in soil and sediment at SEAD-17. VOCs were detected infrequently and in low concentrations. Because of this low prevalence and concentrations, direct volatilization of VOCs was not considered significant in this assessment.

7.3.4.2.2 Semi-Volatile Organics

The principal semi-volatile compounds found in SEAD 17 are PAHs and PCBs. Generally, these constituents are relatively persistent and immobile in the environment. This was verified by the RI sampling programs, which measured elevated concentrations of these constituents in the soil, but not in the groundwater.

7.3.4.2.3 Metals

The behavior of metals in soil is unlike organic compounds in many aspects. For example, volatilization of metals from soil is not considered a realistic mechanism for pollutant migration and was not considered. However, leaching and sorption were considered in the fate and transport evaluation. Leaching of metals from soil is controlled by numerous factors. Most importantly is its chemical form (base metal or cation) in the soil. The leaching of metals from soils is substantial if the metal exists as a soluble salt. Upon contact with surface water or precipitation, the metals, either as metal oxides or metal salts, can be solubilized, eventually leaching to the groundwater. In general, elevated concentrations of metals were not measured in the on-site monitoring wells.

7.3.4.3 Exposure Routes

Exposure routes are the means by which a human potentially contacts COPCs. Not all exposure routes will exist at every site. In general, these include inhalation, ingestion and dermal contact. Exposure pathways that will be evaluated at SEAD 17 are discussed below.

7.3.4.4 Exposure Points

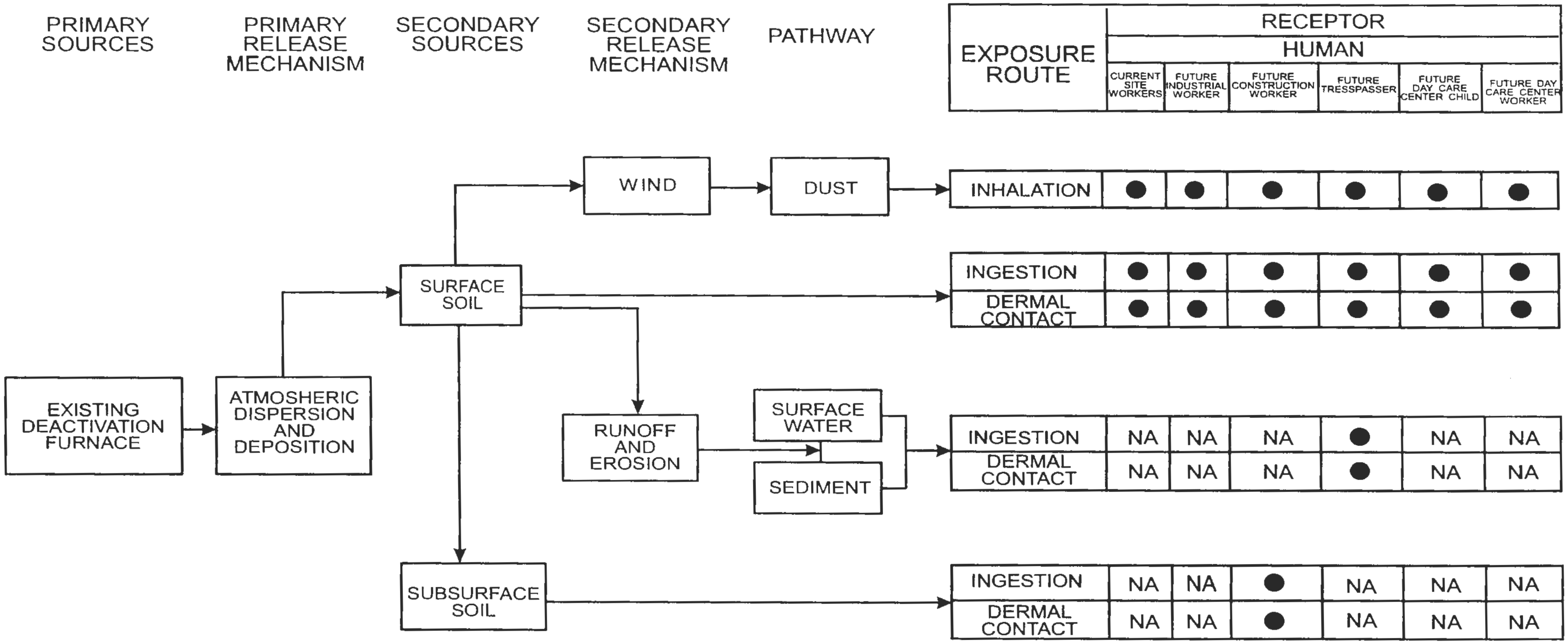
The exposure point is the point of potential human contact with a chemical, either directly at its source or via a transport medium. The exposure points that may exist at SEAD 17 are:

- Ambient air containing suspended soil particles: exposure to all current and future receptors.
- Surface soils: exposure to all receptors by direct contact (ingestion and dermal).
- Subsurface soils: exposure to future construction workers by direct contact.
- Small surface water/sediment areas: exposure to future trespassers by wading (ingestion and dermal).

7.3.4.5 Integration of Exposure Pathways

In this section, the final assembly of the components required to accurately construct an exposure pathway is performed. As described earlier the proper framework of an exposure pathway involves a source, transport medium, exposure point, and an exposure route. The pertinent exposure pathways for SEAD 17 are summarized in Figure 7-3. According to the RAGS (USEPA, 1989a), a pathway is considered incomplete if one or more of these components is not present with the exception of the transport medium, which may be absent in the case of direct exposures. Hence, the conclusion, if there is not a complete pathway, there can be no risk resulting from that theoretical pathway. For the purposes of this baseline risk assessment (BRA), current and future human exposure pathways have been identified as potential pathways which meet the criteria for an exposure pathway (exposure to surface water and sediment are counted separately).

For the current site worker and future industrial worker three exposure pathways are quantified. These are ingestion of surface soils, dermal contact to surface soils, and inhalation of particulates in ambient air. For the future trespasser the following pathways are quantified: ingestion and dermal contact with on-site surface water and sediment while wading; ingestion and dermal contact with site soils; and inhalation of particulates in ambient air. For the future construction worker, dermal contact with and ingestion of all soils, and the inhalation of particulates in ambient air are considered. For the future day care center receptors (adult workers and children



EXPOSURE ROUTE	CURRENT SITE WORKERS	FUTURE INDUSTRIAL WORKER	FUTURE CONSTRUCTION WORKER	FUTURE TRESSPASSER	FUTURE DAY CARE CENTER CHILD	FUTURE DAY CARE CENTER WORKER
INHALATION	●	●	●	●	●	●
INGESTION	●	●	●	●	●	●
DERMAL CONTACT	●	●	●	●	●	●
INGESTION	NA	NA	NA	●	NA	NA
DERMAL CONTACT	NA	NA	NA	●	NA	NA
INGESTION	NA	NA	●	NA	NA	NA
DERMAL CONTACT	NA	NA	●	NA	NA	NA

RECEPTOR: HUMAN

● PATHWAY CONSIDERED TO POSE POTENTIAL RISK

NA NOT APPLICABLE RECEPTOR

PARSONS
PARSONS ENGINEERING SCIENCE, INC.

CLIENT/PROJECT TITLE
SENECA ARMY DEPOT ACTIVITY
RI/FS
SEAD-17 EXISTING DEACTIVATION FURNACE

DEPT. ENVIRONMENTAL ENGINEERING
DWG NO 729895-01002

FIGURE 7-3
EXPOSURE PATHWAY SUMMARY

SCALE NA
DATE MARCH 1998

attendees) the following pathways are quantified: dermal contact with and ingestion of surface soils, and inhalation of particulates in ambient air.

Other pathways were not quantified based on the following rationale:

1. Ingestion and dermal contact from surface water and sediment while swimming were considered to be an unrealistic current and future pathways of exposure because the depth of drainage ditches is at most only a few inches and would prevent a receptor from swimming.

2. Ingestion and dermal contact with soil by current offsite area residents was eliminated from the risk assessment based on the unlikely occurrence of a trespasser at SEAD 17. Security on the depot remains in place which prohibits unauthorized entrance to the grounds.

3. The most realistic current on-site exposure scenario is considered to be the site worker scenario. Because the assumptions are based on present data, it was determined that modeling a future site worker would yield no different risks than the current land use scenario.

7.3.4.6 Summary of Exposure Pathways to be Quantified

The pathways presented reflect the current onsite and the projected future onsite use of the Existing Deactivation Furnace area. This section presents the rationale for including these exposure pathways in this risk assessment.

Inhalation of Particulate Matter in Ambient Air

The laboratory analysis of SEAD 17 surface and subsurface soils shows the presence of volatile organic compounds (VOCs), semi-volatile organic compounds and metals. Surface soil particles may become airborne via wind erosion, which in turn may be inhaled by individuals at the site. Construction workers may also be exposed to subsurface soil particles. Therefore, inhalation exposure to soil particulates in ambient air was assessed for current and future workers, future trespassers and future day care receptors.

Incidental Ingestion and Dermal Contact to On-Site Surface Soils

The laboratory analysis of SEAD 17 surface soils shows the presence of VOCs, semi-volatile organic compounds (including PAHs and pesticides) and metals. During the course of daily activities, an on-site worker or child trespasser could come into contact with these surface soils and involuntarily ingest and/or have their skin exposed to them. Therefore, exposure via dermal contact and soil ingestion was assessed for current infrequent site workers and future workers, trespassers and day care receptors.

Incidental Ingestion and Dermal Contact to On-Site Soils (Future)

The laboratory analysis of SEAD 17 all surface and subsurface soils shows the presence of semi-volatile organics, pesticides/PCBs, and metals. During the course of daily activities, an on-site construction worker will come into contact with these surface and subsurface soils during intrusive activities and may involuntarily ingest and have his/her skin exposed to them. Therefore, exposure via both dermal contact and soil ingestion was assessed for possible future construction worker.

Incidental Dermal Contact to Surface Water and Sediments (Future)

There are no permanent bodies of water at SEAD 17. However, pools of surface water form in drainage ditches at the site following precipitation. This surface water and the associated wet soil, or sediment, may contain chemicals found in the surface soils, since these ditches will collect runoff and soil eroded by the rainfall. While intentional adult contact with this surface water and sediment is unlikely, an adolescent trespasser could potentially wade in these ditches. Due to current site access restrictions, a trespasser cannot contact these drainage ditches currently. Therefore, exposures to surface water and sediments via dermal contact were assessed for a future child trespasser.

Incidental Ingestion of Sediment (Future)

When the drainage ditches are dry, there is potential for contact with the sediment contained in the ditches. While dermal contact with this sediment has been addressed above, there is also the potential that a future trespasser might ingest some of this sediment (similar to soil ingestion). Ingestion exposure to sediment would be limited, since the sediment would often be covered by surface water or snow. Exposure to sediment by ingestion was assessed quantitatively for a future trespasser.

Ingestion of Groundwater (Future)

The only analytes detected in groundwater were found at background concentrations (see discussion in Section 7.2.3). These results indicate that SEAD-17 is not significantly impacting groundwater quality, and no risk from potential future groundwater ingestion at SEAD-17 is attributable to the site. Therefore, ingestion of groundwater was not considered to be an exposure pathway at SEAD-17.

7.3.5 Quantification of Exposure

In this section, each receptor's potential exposures to chemicals of potential concern (COPCs) is quantified for each of the exposure pathways described above. In each case, the exposures are calculated following methods recommended in EPA guidance documents, such as the Risk Assessment Guidance for Superfund (EPA 1989). These calculations generally involve two steps. First, representative chemical concentrations in the environment, or exposure point concentrations (EPCs), are determined for each pathway and receptor. From these EPC values, the amount of chemical which an exposed person may take into his/her body is then calculated. This value is referred to as either the Human Intake or the Absorbed Dose, depending on the exposure route.

Risk assessment as a whole, and the exposure assessment step in particular, are designed to be health protective. The exposure calculations require estimates and assumptions about certain human exposure parameters, such as inhalation rates, ingestion rates, etc. Generally, values are selected which tend to overestimate exposure. USEPA (1993) recommends two types of exposure estimates be used for Superfund risk assessments: a reasonable maximum exposure (RME) and central tendency exposure (CT). The RME is defined as the highest exposure that could reasonably be expected to occur for a given exposure pathway at a site, and is intended to account for both uncertainty in the contaminant concentration and variability in the exposure parameters (such as exposure frequency or averaging time). The CT is also evaluated for comparison purposes and is generally based on mean exposure parameters. In accordance with this EPA guidance, both the CT and RME scenarios have been evaluated in this assessment.

Superfund risk assessments consider chronic exposures unless specific conditions warrant a short-term or an acute assessment. In this evaluation, long-term exposure to relatively low chemical concentrations is the greatest concern. Short-term (i.e., subchronic) exposure were evaluated only for a construction worker, trespasser, and day care child whose exposure durations range from one to six years.

Exposure-point concentrations (EPCs) were estimated for all pathways selected for quantitative evaluation. These concentrations are based on measured values (for soil, sediment, surface water, and groundwater) or on calculated estimates (for ambient air). Steady-state conditions were assumed. Therefore, current and future chemical concentrations were assumed to be identical. This assumption may tend to overestimate long-term exposure concentrations because chemical concentrations are likely to decrease over time from natural processes such as dispersion, attenuation, degradation and dilution.

Estimates of pathway-specific human intakes or absorbed doses for each chemical involve assumptions about patterns of human exposure to contaminated media. These assumptions are integrated with exposure-point concentrations to calculate intakes. Intakes or doses are normally expressed as the amount of chemical at the environment-human receptor exchange boundary in milligrams per kilogram of body weight per day (mg/kg-day), which represents an exposure normalized for body weight over time. The total exposure is divided by the time period of interest to obtain an average exposure. The averaging time is a function of the toxic endpoint: For noncarcinogenic effects, it is the exposure time (specific to the scenario being assessed) and for carcinogenic effects, it is lifetime (70 years).

7.3.5.1 Exposure Assumptions

An important aspect of exposure assessment is the determination of sets of assumptions regarding the manner in which receptors may be exposed to contaminants. USEPA guidance on exposure factors is extensive and was followed throughout this exposure assessment. Standard scenarios and EPA-recommended default assumptions were used where appropriate.

The exposure scenarios in this assessment involve the following receptors: current site worker, future industrial worker, future construction worker, and future child trespasser. The exposure assumptions for these scenarios are intended to approximate the frequency and duration of time and manner in which receptors are exposed to environmental media. For example, the commercial/industrial scenario is intended to approximate the exposure potential of those employed in the building at the site. The trespasser scenario is intended for use where occasional exposures are expected to occur, and in specifically limited fashion.

Two types of exposure estimates are presented in this risk assessment: RME and CT. Exposure assumptions specific to each type of estimate were used. Details of the exposure assumptions and parameters for each exposure scenario are shown in Table 7-5.

The primary sources for the RME and CT exposure factors are as follows:

- USEPA, 1988: Superfund Exposure Assessment Manual
- USEPA, 1989: Risk Assessment Guidance for Superfund, Volume I (RAGS)
- USEPA, 1991: Supplemental Guidance, Standard Default Exposure Factors
- USEPA, 1992: Dermal Exposure Assessment, Principles and Applications
- USEPA, 1993: Superfund's Standard Default Exposure for the Central Tendency and Reasonable Maximum Exposure

Table 7-5

EXPOSURE FACTOR ASSUMPTIONS

SEAD 17-Remedial Investigation
Seneca Army Depot Activity

RECEPTOR	EXPOSURE ROUTE	RME/CT	PARAMETER	VALUE	UNITS	BASIS	SOURCE
CURRENT SITE WORKER	**Inhalation of Dust in Ambient Air** (Air EPC Calculated from Surface Soil Only)	RME & CT	Inhalation Rate	9.6	m3/day	Average inhalation rate for moderate activity is 1.2 m3/hr, 8 hr work day	USEPA, 1996
			Body Weight	70	kg	Standard reference weight for adult males	USEPA, 1991
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Exposure Frequency	20	days/yr	Assumed	BPJ
			Exposure Duration	25	years	Upper bound time for employment at a job	USEPA, 1991, 1993
			Averaging Time - Nc	9125	days	25 years	USEPA, 1989
		CT	Exposure Frequency	10	days/yr	Assumed	BPJ
			Exposure Duration	7	years	Mean time for employment at a job	USEPA, 1996
			Averaging Time - Nc	2555	days	7 years	USEPA, 1989
	Ingestion of Soil (Soil EPC Calculated from Surface Soil Only)	RME & CT	Body Weight	70	kg	Standard reference weight for adult males	USEPA, 1991
			Fraction Ingested	1	(unitless)	100% ingestion, conservative assumption	BPJ
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Ingestion Rate	100	mg soil/day	Upper bound worker exposure to dirt and dust	USEPA, 1993
			Exposure Frequency	20	days/yr	Assumed	BPJ
			Exposure Duration	25	years	Upper bound time for employment at a job	USEPA, 1991, 1993
			Averaging Time - Nc	9125	days	25 years	USEPA, 1989
		CT	Ingestion Rate	50	mg soil/day	Average worker exposure to dirt and dust	USEPA, 1993
			Exposure Frequency	10	days/yr	Assumed	BPJ
			Exposure Duration	7	years	Mean time for employment at a job	USEPA, 1996
			Averaging Time - Nc	2555	days	7 years	USEPA, 1989
	Dermal Contact - Soil (Soil EPC Calculated from Surface Soil Only)	RME & CT	Body Weight	70	kg	Standard reference weight for adult males	USEPA, 1991
			Absorption Factor	Compound Specific			USEPA, 1992
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Skin Contact Surface Area	5800	cm2	Hands, legs, arms, neck and head exposed, 25% of upper bound body skin area of adult	USEPA, 1992
			Soil to Skin Adherence Factor	1	mg/cm2	Upper bound soil to skin adherence factor	USEPA, 1992
			Exposure Frequency	20	days/yr	Assumed	BPJ
			Exposure Duration	25	years	Upper bound time for employment at a job	USEPA, 1991, 1993
			Averaging Time - Nc	9125	days	25 years	USEPA, 1989
		CT	Skin Contact Surface Area	5000	cm2	Hands, legs, arms, neck and head exposed, 25% of average body skin area of adult	USEPA, 1992
			Soil to Skin Adherence Factor	0.2	mg/cm2	Average soil to skin adherence factor	USEPA, 1992
			Exposure Frequency	10	days/yr	Assumed	BPJ
			Exposure Duration	7	years	Mean time for employment at a job	USEPA, 1996
			Averaging Time - Nc	2555	days	7 years	USEPA, 1989

Table 7-5

EXPOSURE FACTOR ASSUMPTIONS

SEAD 17-Remedial Investigation
Seneca Army Depot Activity

RECEPTOR	EXPOSURE ROUTE	RME/CT	PARAMETER	VALUE	UNITS	BASIS	SOURCE
FUTURE INDUSTRIAL WORKER	**Inhalation of Dust in Ambient Air** (Air EPC Calculated from Surface Soil Only)	RME & CT	Inhalation Rate	9.6	m3/day	Average inhalation rate for moderate activity is 1.2 m3/hr, 8 hr work day	USEPA, 1996
			Body Weight	70	kg	Standard reference weight for adult males	USEPA, 1991
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Exposure Frequency	250	days/yr	Assumes works 5 days/wk and 10 days/yr vacation	USEPA, 1991
			Exposure Duration	25	years	Upper bound time for employment at a job	USEPA, 1991, 1993
			Averaging Time - Nc	9125	days	25 years	USEPA, 1989
		CT	Exposure Frequency	219	days/yr	Mean for adult workers	USEPA, 1993
			Exposure Duration	7	years	Mean time for employment at a job	USEPA, 1996
			Averaging Time - Nc	2555	days	7 years	USEPA, 1989
	Ingestion of Soil (Soil EPC Calculated from Surface Soil Only)	RME & CT	Body Weight	70	kg	Standard reference weight for adult males	USEPA, 1991
			Fraction Ingested	1	(unitless)	100% ingestion, conservative assumption	BPJ
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Ingestion Rate	100	mg solids/day	Upper bound worker exposure to dirt and dust	USEPA, 1993
			Exposure Frequency	250	days/yr	Assumes works 5 days/wk and 10 days/yr vacation	USEPA, 1991
			Exposure Duration	25	years	Upper bound time for employment at a job	USEPA, 1991, 1993
			Averaging Time - Nc	9125	days	25 years	USEPA, 1989
		CT	Ingestion Rate	50	mg solids/day	Average worker exposure to dirt and dust	USEPA, 1993
			Exposure Frequency	219	days/yr	Mean for adult workers	USEPA, 1993
			Exposure Duration	7	years	Mean time for employment at a job	USEPA, 1996
			Averaging Time - Nc	2555	days	7 years	USEPA, 1989
	Dermal Contact - Soil (Soil EPC Calculated from Surface Soil Only)	RME & CT	Body Weight	70	kg	Standard reference weight for adult males	USEPA, 1991
			Absorption Factor	Compound Specific			USEPA, 1992
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Skin Contact Surface Area	5800	cm2	Hands, legs, arms, neck and head exposed, 25% of upper bound body skin area of adult	USEPA, 1992
			Soil to Skin Adherence Factor	1	mg/cm2	Upper bound soil to skin adherence factor	USEPA, 1992
			Exposure Frequency	250	days/yr	Assumes works 5 days/wk and 10 days/yr vacation	USEPA, 1991
			Exposure Duration	25	years	Upper bound time for employment at a job	USEPA, 1991, 1993
			Averaging Time - Nc	9125	days	25 years	USEPA, 1989
		CT	Skin Contact Surface Area	5000	cm2	Hands, legs, arms, neck and head exposed, 25% of average body skin area of adult	USEPA, 1992
			Soil to Skin Adherence Factor	0.2	mg/cm2	Average soil to skin adherence factor	USEPA, 1992
			Exposure Frequency	219	days/yr	Mean for adult workers	USEPA, 1993
			Exposure Duration	7	years	Mean time for employment at a job	USEPA, 1996
			Averaging Time - Nc	2555	days	7 years	USEPA, 1989

Table 7-5

EXPOSURE FACTOR ASSUMPTIONS

SEAD 17-Remedial Investigation
Seneca Army Depot Activity

RECEPTOR	EXPOSURE ROUTE	RME/CT	PARAMETER	VALUE	UNITS	BASIS	SOURCE
FUTURE CONSTRUCTION WORKER	**Inhalation of Dust in Ambient Air**	RME & CT	Inhalation Rate	10.4	m3/day	Average inhalation rate for outdoor worker is 1.3 m3/hr, 8 hr work day	USEPA, 1996
			Body Weight	70	kg	Standard reference weight for adult males	USEPA, 1991
			Exposure Duration	1	year	Upper bound time of employment for constr. worker	USEPA, 1991
	(Air EPC Calculated from Surface and Subsurface Soils)		Averaging Time - Nc	365	days	1 year	USEPA, 1989
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Exposure Frequency	250	days/yr	Assumes works 5 days/wk and 10 days/yr vacation	USEPA, 1991
		CT	Exposure Frequency	219	days/yr	Mean for adult workers	USEPA, 1993
	Ingestion of Soil	RME & CT	Body Weight	70	kg	Standard reference weight for adult males	USEPA, 1991
			Fraction Ingested	1	(unitless)	100% ingestion, conservative assumption	BPJ
	(Soil EPC Calculated from Surface and Subsurface Soils)		Exposure Duration	1	year	Upper bound time of employment for constr. worker	USEPA, 1991
			Averaging Time - Nc	365	days	1 year	USEPA, 1989
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Ingestion Rate	480	mg soil/day	Assumed IR for intensive construction work	USEPA, 1991, 1993
			Exposure Frequency	250	days/yr	Assumes works 5 days/wk and 10 days/yr vacation	USEPA, 1991
		CT	Ingestion Rate	100	mg soil/day	Assumed average IR for construction work	USEPA, 1993
			Exposure Frequency	219	days/yr	Mean for adult workers	USEPA, 1993
	Dermal Contact - Soil	RME & CT	Body Weight	70	kg	Standard reference weight for adult males	USEPA, 1991
			Absorption Factor	Compound Specific			USEPA, 1992
	(Soil EPC Calculated from Surface and Subsurface Soils)		Exposure Duration	1	year	Upper bound time of employment for constr. worker	USEPA, 1991
			Averaging Time - Nc	365	days	1 year	USEPA, 1989
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Skin Contact Surface Area	5800	cm2	Hands, legs, arms, neck and head exposed, 25% of upper bound body skin area of adult	USEPA, 1992
			Soil to Skin Adherence Factor	1	mg/cm2	Upper bound soil to skin adherence factor	USEPA, 1992
			Exposure Frequency	250	days/yr	Assumes works 5 days/wk and 10 days/yr vacation	USEPA, 1991
		CT	Skin Contact Surface Area	5000	cm2	Hands, legs, arms, neck and head exposed, 25% of average body skin area of adult	USEPA, 1992
			Soil to Skin Adherence Factor	0.2	mg/cm2	Average soil to skin adherence factor	USEPA, 1992
			Exposure Frequency	219	days/yr	Mean for adult workers	USEPA, 1993

Table 7-5

EXPOSURE FACTOR ASSUMPTIONS

SEAD 17-Remedial Investigation
Seneca Army Depot Activity

RECEPTOR	EXPOSURE ROUTE	RME/CT	PARAMETER	VALUE	UNITS	BASIS	SOURCE
FUTURE TRESSPASSER CHILD	**Inhalation of Dust in Ambient Air** (Air EPC Calculated from Surface Soil Only)	RME & CT	Inhalation Rate	1.2	m3/day	Average inhalation rate for moderate activity is 1.2 m3/hr, exposure time of 1 hr/day	USEPA, 1996
			Exposure Time	1	hr/day		BPJ
			Body Weight	50	kg	mean weight for 13 year old	USEPA, 1996
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Exposure Frequency	50	days/yr	2 days/wk, 25 wk/yr	BPJ
			Exposure Duration	5	years	Assumed	BPJ
			Averaging Time - Nc	1825	days	5 years	USEPA, 1989
		CT	Exposure Frequency	25	days/yr	1 day/wk, 25 wk/yr	BPJ
			Exposure Duration	1	year	Assumed	BPJ
			Averaging Time - Nc	365	days	1 year	USEPA, 1989
	Ingestion of Soil (Soil EPC Calculated from Surface Soil Only)	RME & CT	Body Weight	50	kg	mean weight for 13 year old	USEPA, 1996
			Fraction Ingested	1	(unitless)	100% ingestion, conservative assumption	BPJ
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Ingestion Rate	200	mg soil/day	Maximum IR for a child	USEPA, 1993
			Exposure Frequency	50	days/yr	2 days/wk, 25 wk/yr	BPJ
			Exposure Duration	5	years	Assumed	BPJ
			Averaging Time - Nc	1825	days	5 years	USEPA, 1989
		CT	Ingestion Rate	100	mg soil/day	Average IR for a child	USEPA, 1993
			Exposure Frequency	25	days/yr	1 day/wk, 25 wk/yr	BPJ
			Exposure Duration	1	year	Assumed	BPJ
			Averaging Time - Nc	365	days	1 year	USEPA, 1989
	Dermal Contact - Soil (Soil EPC Calculated from Surface Soil Only)	RME & CT	Body Weight	50	kg	mean weight for 13 year old	USEPA, 1996
			Absorption Factor	Compound Specific			USEPA, 1992
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Skin Contact Surface Area	4625	cm2	Hands, legs, arms, neck and head exposed, 25% of upper bound body skin area of a 12-15 year old	USEPA, 1992
			Soil to Skin Adherence Factor	1	mg/cm2	Upper bound soil to skin adherence factor	USEPA, 1992
			Exposure Frequency	50	days/yr	2 days/wk, 25 wk/yr	BPJ
			Exposure Duration	5	years	Assumed	BPJ
			Averaging Time - Nc	1825	days	5 years	USEPA, 1989
		CT	Skin Contact Surface Area	3725	cm2	Hands, legs, arms, neck and head exposed, 25% of average body skin area of a 12-15 year old	USEPA, 1992
			Soil to Skin Adherence Factor	0.2	mg/cm2	Average soil to skin adherence factor	USEPA, 1992
			Exposure Frequency	25	days/yr	1 day/wk, 25 wk/yr	BPJ
			Exposure Duration	1	year	Assumed	BPJ
			Averaging Time - Nc	365	days	1 year	USEPA, 1989
	Dermal Contact - Surface Water	RME & CT	Body Weight	50	kg	mean weight for 13 year old	USEPA, 1996
			Absorption Factor	Compound Specific			USEPA, 1992
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Skin Contact Surface Area	4625	cm2	Feet and legs exposed; 25% of upper bound body skin area of a 12-15 year old	USEPA, 1992
			Exposure Frequency	25	days/yr	2 days/wk, 13 wk/yr	BPJ
			Exposure Duration	5	years	Assumed	BPJ
			Averaging Time - Nc	1825	days	5 years	USEPA, 1989
		CT	Skin Contact Surface Area	3725	cm2	Feet and legs exposed; 25% of average body skin area of a 12-15 year old	USEPA, 1992
			Exposure Frequency	13	days/yr	1 day/wk, 13 wk/yr	BPJ
			Exposure Duration	1	year	Assumed	BPJ
			Averaging Time - Nc	365	days	1 year	USEPA, 1989

Table 7-5

EXPOSURE FACTOR ASSUMPTIONS

SEAD 17-Remedial Investigation
Seneca Army Depot Activity

RECEPTOR	EXPOSURE ROUTE	RME/CT	PARAMETER	VALUE	UNITS	BASIS	SOURCE
FUTURE TRESSPASSER CHILD (continued)	**Dermal Contact - Sediment**	RME & CT	Body Weight	50	kg	mean weight for 13 year old	USEPA, 1996
			Absorption Factor	Compound Specific			USEPA, 1992
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Skin Contact Surface Area	4625	cm2	Feet and legs exposed; 25% of upper bound body skin area of a 12-15 year old	USEPA, 1992
			Soil to Skin Adherence Factor	1	mg/cm2	Upper bound soil to skin adherence factor	USEPA, 1992
			Exposure Frequency	25	days/yr	1 day/wk, 25 wk/yr	BPJ
			Exposure Duration	5	years	Assumed	BPJ
			Averaging Time - Nc	1825	days	5 years	USEPA, 1989
		CT	Skin Contact Surface Area	3725	cm2	Feet and legs exposed; 25% of average body skin area of a 12-15 year old	USEPA, 1992
			Soil to Skin Adherence Factor	0.2	mg/cm2	Average soil to skin adherence factor	USEPA, 1992
			Exposure Frequency	13	days/yr	1 day/wk, 13 wk/yr	BPJ
			Exposure Duration	1	year	Assumed	BPJ
			Averaging Time - Nc	365	days	1 year	USEPA, 1989
	Ingestion - Sediment	RME & CT	Body Weight	50	kg	mean weight for 13 year old	USEPA, 1996
			Fraction Ingested	1	(unitless)	100% ingestion, conservative assumption	BPJ
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Ingestion Rate	200	mg/day	Maximum IR for a child	USEPA, 1993
			Exposure Frequency	25	days/yr	1 day/wk, 25 wk/yr	BPJ
			Exposure Duration	5	years	Assumed	BPJ
			Averaging Time - Nc	1825	days	5 years	USEPA, 1989
		CT	Ingestion Rate	100	mg/day	Average IR for a child	USEPA, 1993
			Exposure Frequency	13	days/yr	1 day/wk, 13 wk/yr	BPJ
			Exposure Duration	1	year	Assumed	BPJ
			Averaging Time - Nc	365	days	1 year	USEPA, 1989

Table 7-5

EXPOSURE FACTOR ASSUMPTIONS

SEAD 17-Remedial Investigation
Seneca Army Depot Activity

RECEPTOR	EXPOSURE ROUTE	RME/CT	PARAMETER	VALUE	UNITS	BASIS	SOURCE
FUTURE DAY CARE CENTER CHILD	**Inhalation of Dust in Ambient Air** (Air EPC Calculated from Surface Soil Only)	RME & CT	Inhalation Rate	4	m3/day	Average non-sleeping inhalation rate for 3-5 year olds is 0.4 m3/hr, exposure time 10 hr/day	USEPA, 1996
			Body Weight	15	kg	mean weight for 0-6 year olds	USEPA, 1993
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Exposure Frequency	250	days/yr	Assumes attends 5 days/wk and 10 days vacation	USEPA, 1991
			Exposure Duration	6	years	Assumes attends from 0-6 years old	BPJ
			Averaging Time - Nc	2190	days	6 years	USEPA, 1989
		CT	Exposure Frequency	219	days/yr	Average for occupational workers	USEPA, 1993
			Exposure Duration	3	years		BPJ
			Averaging Time - Nc	1095	days		BPJ
	Ingestion of Soil (Soil EPC Calculated from Surface Soil Only)	RME & CT	Body Weight	15	kg	mean weight for 0-6 year olds	USEPA, 1993
			Fraction Ingested	1	(unitless)	100% ingestion, conservative assumption	BPJ
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Ingestion Rate	200	mg soil/day	Maximum IR for a child	USEPA, 1993
			Exposure Frequency	250	days/yr	Assumes attends 5 days/wk and 10 days vacation	USEPA, 1991
			Exposure Duration	6	years	Assumes attends from 0-6 years old	BPJ
			Averaging Time - Nc	2190	days	6 years	USEPA, 1989
		CT	Ingestion Rate	100	mg soil/day	Average IR for a child	USEPA, 1993
			Exposure Frequency	219	days/yr	Average for occupational workers	USEPA, 1993
			Exposure Duration	3	years		BPJ
			Averaging Time - Nc	1095	days		BPJ
	Dermal Contact - Soil (Soil EPC Calculated from Surface Soil Only)	RME & CT	Body Weight	15	kg	mean weight for 0-6 year olds	USEPA, 1993
			Absorption Factor	Compound Specific			
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Skin Contact Surface Area	2190	cm2	Hands. legs, arms, neck and head exposed; 25% of upper bound body skin area of a 3-6 year old	USEPA, 1992
			Soil to Skin Adherence Factor	1	mg/cm2	Upper bound soil to skin adherence factor	USEPA, 1992
			Exposure Frequency	250	days/yr	Assumes attends 5 days/wk and 10 days vacation	USEPA, 1991
			Exposure Duration	6	years	Assumes attends from 0-6 years old	BPJ
			Averaging Time - Nc	2190	days	6 years	USEPA, 1989
		CT	Skin Contact Surface Area	1820	cm2	Hands. legs, arms, neck and head exposed; 25% of average body skin area of a 3-6 year old	USEPA, 1992
			Soil to Skin Adherence Factor	0.2	mg/cm2	Average soil to skin adherence factor	USEPA, 1992
			Exposure Frequency	219	days/yr	Average occupational workers	USEPA, 1993
			Exposure Duration	3	years		BPJ
			Averaging Time - Nc	1095	days		BPJ

Table 7-5

EXPOSURE FACTOR ASSUMPTIONS

SEAD 17-Remedial Investigation
Seneca Army Depot Activity

RECEPTOR	EXPOSURE ROUTE	RME/CT	PARAMETER	VALUE	UNITS	BASIS	SOURCE
FUTURE DAY CARE CENTER WORKER	**Inhalation of Dust in Ambient Air** (Air EPC Calculated from Surface Soil Only)	RME & CT	Inhalation Rate	8	m3/day	Average inhalation rate for light activity is 1 m3/hr, 8 hr work day	USEPA, 1991, 1993
			Body Weight	70	kg	Standard reference weight for adult males	USEPA, 1991
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Exposure Frequency	250	days/yr	Assumes works 5 days/wk and 10 days/yr vacation	USEPA, 1991
			Exposure Duration	25	years	Upper bound time for employment at a job	USEPA, 1991, 1993
			Averaging Time - Nc	9125	days	25 years	USEPA, 1989
		CT	Exposure Frequency	219	days/yr	Mean for adult workers	USEPA, 1993
			Exposure Duration	7	years	Mean time for employment at a job	USEPA, 1996
			Averaging Time - Nc	2555	days	7 years	USEPA, 1989
	Ingestion of Soil (Soil EPC Calculated from Surface Soil Only)	RME & CT	Body Weight	70	kg	Standard reference weight for adult males	USEPA, 1991
			Fraction Ingested	1	(unitless)	100% ingestion, conservative assumption	BPJ
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Ingestion Rate	100	mg soil/day	Upper bound worker exposure to dirt and dust	USEPA, 1993
			Exposure Frequency	250	days/yr	Assumes works 5 days/wk and 10 days/yr vacation	USEPA, 1991
			Exposure Duration	25	years	Upper bound time for employment at a job	USEPA, 1991, 1993
			Averaging Time - Nc	9125	days	25 years	USEPA, 1989
		CT	Ingestion Rate	50	mg soil/day	Average worker exposure to dirt and dust	USEPA, 1993
			Exposure Frequency	219	days/yr	Mean for adult workers	USEPA, 1993
			Exposure Duration	7	years	Mean time for employment at a job	USEPA, 1996
			Averaging Time - Nc	2555	days	7 years	USEPA, 1989
	Dermal Contact - Soil (Soil EPC Calculated from Surface Soil Only)	RME & CT	Body Weight	70	kg	Standard reference weight for adult males	USEPA, 1991
			Absorption Factor	Compound Specific			USEPA, 1992
			Averaging Time - Car	25550	days	70 years, conventional human life span	USEPA, 1989
		RME	Skin Contact Surface Area	5800	cm2	Hands, legs, arms, neck and head exposed, 25% of upper bound body skin area of adult	USEPA, 1992
			Soil to Skin Adherence Factor	1	mg/cm2	Upper bound soil to skin adherence factor	USEPA, 1992
			Exposure Frequency	250	days/yr	Assumes works 5 days/wk and 10 days/yr vacation	USEPA, 1991
			Exposure Duration	25	years	Upper bound time for employment at a job	USEPA, 1991, 1993
			Averaging Time - Nc	9125	days	25 years	USEPA, 1989
		CT	Skin Contact Surface Area	5000	cm2	Hands, legs, arms, neck and head exposed, 25% of average body skin area of adult	USEPA, 1992
			Soil to Skin Adherence Factor	0.2	mg/cm2	Average soil to skin adherence factor	USEPA, 1992
			Exposure Frequency	219	days/yr	Mean for adult workers	USEPA, 1993
			Exposure Duration	7	years	Mean time for employment at a job	USEPA, 1996
			Averaging Time - Nc	2555	days	7 years	USEPA, 1989

RME = Resonable Maximum Exposure
CT = Central Tendency
Car = Carcinogenic
Nc = Non-carcinogenic

Source References:
- USEPA, 1988: Superfund Exposure Assessment Manual
- USEPA, 1989: Risk Assessment Guidance for Superfund, Volume I (RAGS)
- USEPA, 1991: Supplemental Guidance, Standard Default Exposure Factors
- USEPA, 1992: Dermal Exposure Assessment, Principles and Applications
- USEPA, 1993: Superfund's Standard Default Exposure for the Central Tendency and Reasonable Maximum Exposure
- USEPA, 1996: Exposure Factors Handbook, Draft update to 1990 handbook

- USEPA, 1996: Exposure Factors Handbook

In the following sections, the methods used to calculate exposures by each pathway are explained. Tables which show the human intake or absorbed dose values calculated for each exposure scenario are contained in Appendix J. These intakes and doses are used to assess overall carcinogenic and non-carcinogenic risk, as discussed later in the risk characterization section (Section 7.5).

7.3.5.2 Exposure Scenarios

The four exposure scenarios and their respective exposure assumptions in this assessment are described below.

Current Site Worker. Current workers at the site spend their time throughout the entire SEDA. Therefore, the current site worker is assumed to visit SEAD 17 infrequently. During these visits, this worker inhales the ambient air at SEAD 17 and may ingest or dermally contact the surface soil there. Based on professional judgment, it was assumed that the current site worker visits SEAD 17 on 20 days per year, as the reasonable maximum exposure (RME) and 10 days per year, as the central tendency (CT). All other exposure factors used in the exposure assessment were obtained from EPA guidance documents, as noted in Table 7-5.

Future Construction Worker. Future construction workers are assumed to spend one year working at SEAD 17, which is a typical duration for a significant construction project. These workers spend each working day at SEAD 17 (5 days/week for 50 weeks, RME; slightly less for the CT). During this time, this worker inhales the ambient air at SEAD 17 and may ingest or dermally contact the soil there. Since the construction worker may be digging onsite, the soil ingestion or dermal contact with both surface and subsurface soils was assumed. Also, inhalation of respirable particulates consisting of surface and subsurface soils was assumed. All other exposure factors used in the exposure assessment were obtained from EPA guidance documents, as noted in Table 7-5.

Future Industrial Worker. Future industrial workers are assumed to work either at the open building at SEAD 17 which housed the deactivation furnace or inside a new building constructed at the site. These workers spend each working day at SEAD 17 (5 days/week for 50 weeks, RME; slightly less for the CT). This exposure period lasts for an entire 25 year career (RME) or a more typical 5 year job span (CT). During this time, this worker inhales the ambient air at SEAD 17 and may ingest or dermally contact the surface soils. All other exposure factors used in the exposure assessment were obtained from EPA guidance documents, as noted in Table 7-5.

Future Adolescent Trespasser. Future public exposure to SEAD 17 may occur during infrequent visits to the site. There will be no residences at SEAD 17; however it is conceivable that people living at nearby residences could occasionally visit this area. This visitor, or trespasser, was assumed to be an adolescent. Based on professional judgment, it was assumed that the future trespasser visits SEAD 17 on 50 days per year, as the reasonable maximum exposure (RME) and 25 days per year, as the central tendency (CT). The rationale for this frequency is twice or once per week, for the RME and CT respectively, during the warmer months (25 weeks assumed). These visits continue for 5 years (RME) or just one year (CT). During these visits, this trespasser inhales the ambient air at SEAD 17 and may ingest or dermally contact the surface soil, standing surface water and sediment there. Several of these exposure pathways were considered possible during each visit: inhalation, ingestion and dermal contact with soil. Exposure by the remaining pathways was assumed to be less frequent. For example, contact with surface water requires standing water to be present (which occurs only after rainfall) and deliberate contact with this water. Accordingly, exposure via the surface water pathway was assumed to occur only during half of the site visits. Ingestion of sediment is assumed to occur when the drainage ditches are dry, when the sediment could potentially be ingested in the same manner as soil. This pathway is assumed to have the same exposure frequency (EF) and exposure duration (ED) used for the surface water pathway, since ingestion of dry sediment is expected to be about as infrequent as wading in the wet drainage ditches. All other exposure factors used in the exposure assessment were obtained from EPA guidance documents, as noted in Table 7-5.

Future Day Care Center Child. It is possible that a day care center could be established onsite as part of a future commercial/industrial enterprise. Future day care children are assumed to attend the center 5 days/week, 12 hours/day, 50 weeks/year for 6 years for the RME scenario. The CT scenario assumes day care center attendance for 5 days/week, 10 hours/day, 48 weeks/year for 3 years. During this time, the child inhales the ambient air, and ingests and dermally contacts surface soil.

Future Day Care Center Worker. The adult worker at the day care center has the same work schedule and exposure duration as the future industrial worker. Like the day care child, the day care center worker inhales the ambient air, and ingests and dermally contacts surface soil.

7.3.5.3 Inhalation of Particulate Matter in Ambient Air

This pathway consists of particulate matter (PM) being released from soils to the air and then being inhaled by current and future receptors. Ambient PM concentrations for a construction worker were estimated using an emission and dispersion model. PM concentrations for the site worker, future trespasser and day care receptors were based on existing site air measurements shown in Table 7-6.

Construction Worker

During construction activities, construction workers may be exposed to chemicals in site soils via inhalation. Construction activities, such as excavation, have the potential to create dust, or suspended particulate matter (PM), originating from the soils being removed. This dust would contain the chemicals present in the soil. Construction workers in the construction area would breathe this PM in the ambient air.

Air concentrations of site chemicals of concern were estimated for this exposure pathway using excavation models recommended in the USEPA's "Models for Estimating Air Emission Rates from Superfund Remedial Actions" (EPA 451/R-93-001).

Particulate emissions from soil excavation and loading into trucks are estimated with the following equation:

$$E = \frac{k\,(0.0016)(M)[U/2.2]^{1.3}}{[X/2]^{1.4}}$$

where:

E = emissions (g)
k = particle size multiplier (unitless)
0.0016 = empirical constant (g/kg)
M = mass of soil handled (kg)
U = mean wind speed (m/sec)
2.2 = empirical constant (m/sec)
X = percent moisture content (%)

The construction worker receptor is assumed to work at SEAD 17 for a one year period. To conservatively estimate potential particulate emissions from construction activities during this period, it was assumed that the area of SEAD 17 where metals were detected in the soils (an approximate 150,000 square foot area) is excavated to a depth of two meters over the course of one year. This results in the following mass of soil removed:

TABLE 7-6

Suspended Particulate Concentrations Measured at SEDA

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

	SITE #1		SITE #2		SITE #3		SITE #4	
PARTICULATE DATA	TSP	PM 10	TSP	PM 10	TSP	PM 10	TSP	PM 10
Peak Concentration (ug/m3)	47 on 20 June 95	37 on 23 July 95	91 on 29 June 95	37 on 23 July 95	72 on 20 June 95	37 on 5 July 95	47 on 20 June 95	37 on 5 July 95
Arithmetic Mean (ug/m3)	26.7	16.9	37.7	16.6	28.5	16.4	27.6	15.8
Standard Deviation	8.4	21.4	16.0	21.1	17.7	23.0	19.7	23.0
Geometric Mean (ug/m3)	25.0	15.1	35.1	14.8	25.9	14.8	26.2	14.2
No. of 24-hr. Avgs. Above 150 ug/m3	0	0	0	0	0	0	0	0
Number of Valid Samples	30	29	22	32	31	29	31	31
Percent Data Recovery	93.8	90.6	68.8	100.0	96.9	90.6	96.9	96.9

Cumulative Summary for April 1, 1995 through July 31, 1995

Mass = Area x Depth x Soil Bulk Density

= 13,900 square meters x 2 meters x 1.5 g/cm^3 x 10^6 cm^3/m^3
= 4.18×10^{10} grams
= 4.18×10^7 kg

This mass of soil is assumed to be handled (i.e. excavated, dumped into piles or loaded into a truck) twice. Therefore, the effective mass (M) for the model is double the actual mass, or 8.36×10^7 kg.

Other parameter values for the model are as follows:

k = 0.35 for PM_{10} (USEPA 1993)
U = 4.4 m/sec, average wind speed for Syracuse, NY (USEPA 1985)
X = 10%, recommended default (USEPA 1993)

With these values for M, k, U and X, the emission rate (E) from excavation activities is 12,111 grams of PM_{10} over the course of a year. This is equivalent to an average emission rate of 48.4 g/day, 6.06 g/hr or 1.68 mg/sec, assuming emission occur only during work days: 250 days/yr, 8hr/day.

Much greater short-term emissions are estimated for site grading with a bulldozer or tractor. This type of activity is assumed to occur for 30 work days (8-hour day) over the course of a year. The model equation for grading emissions is:

$$E = \frac{0.094(s)^{1.5}}{X^{1.4}}$$

where:
E = emission rate (g/sec)
0.094 = empirical constant (g/sec)
s = percent silt content (%)
X = percent moisture content (%)

Assuming the EPA-recommended default values of 8% for s, and 10% for X, the emission rate (E) from grading is calculated as 0.085 g/sec. Averaged over the course of a year with 30 8-hour days of grading emissions, this is 36.7 g/hr or 10.2 mg/sec of PM_{10} emissions, assuming all emissions occur during working hours.

Total annual average emissions from excavation and grading are estimated as 1.68 mg/sec + 10.2 mg/sec = 11.9 mg/sec.

Localized exposure concentrations for construction workers are estimated with a simple box model. The model treats a defined surface area as a uniform emission source over the time period of interest. The box, or mixing volume, is defined by this surface area and an assumed mixing height. The emitted PM_{10} is assumed to mix uniformly throughout the box, with dilution from surface winds.

The general model equation is:

$$C = \frac{E}{(U)(W)(H)}$$

where:

E = emission rate, mg/sec
U = wind speed, m/sec
W = crosswind width of the area source, m
H = mixing height, m

E and U are the same as defined or calculated above. To determine W, the construction activity is assumed to be confined to approximately 100 square meters at any time. This area is assumed to be square, and W is the square root of 100 m^2, or 10 meters. H is assumed to be the height of the breathing zone, or 1.75 meters.

With these values, the PM_{10} exposure concentration for a construction worker is calculated as 0.154 mg/m^3. All of this PM_{10} was assumed to be airborne soil released from SEAD 17 as represented by total soils (surface and subsurface).

The concentration of particulate-associated chemicals in ambient air, then, is:

$$CA = CS \times PM_{10} \times CF$$

where:

CA = chemical concentration in air (mg/m^3)
CS = chemical concentration in soil (mg/kg soil)

PM_{10} = PM_{10} concentration (ug/m^3)
CF = conversion factor (10^{-9} kg/ug)

These calculated CA values are the inhalation EPCs for the dust inhalation scenarios. Table J-1 in Appendix J shows the inhalation EPCs for the future construction worker.

Site Worker, Future Trespasser and Day Care Receptors

Ambient air normally contains particulate matter derived from various natural and anthropogenic sources, including soil erosion, fuel burning, automobiles, etc. The concentrations of airborne particulate matter were measured at SEDA over a four month period (April-July) in 1995. A summary of the data collected in this air sampling program is shown in Table 7-6. Both Total Suspended Particulate Matter (TSP) and particulate matter less than 10um aerodynamic diameter (PM_{10}) were measured. TSP includes all particles which can remain suspended in air, while PM_{10} includes only smaller particles which can be inhaled (particles larger than 10um diameter typically cannot enter the narrow airways in the lung).

For this assessment, the highest 4-month average PM_{10} concentration measured at any of the four monitoring stations was assumed to represent ambient air at SEAD 17. The entire particulate loading was assumed to be airborne soil released from SEAD 17 as represented by the surface soil EPCs for the site.

The concentration of particulate-associated chemicals in ambient air (CA) was calculated with the same equation [$CA = CS \times PM_{10} \times CF$] used for the construction worker, above.

The ambient air exposure point concentrations used in the following intake calculations are found in Table J-1.

The equation for intake is as follows (EPA,1989a):

$$\textbf{Intake (mg/kg/day)} = \frac{\mathbf{CA \times IR \times EF \times ED}}{\mathbf{BW \times AT}}$$

where:

CA = Chemical concentration in air (mg/m^3)
IR = Inhalation Rate (m^3/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)

BW = Bodyweight (kg)
AT = Averaging Time (days)

The results of these calculations are shown in Tables J-2 and J-3 for RME and CT, respectively.

7.3.5.4 Incidental Ingestion of Soil (current and future land use)

Due to the present limited access to the SEAD 17, the current ingestion of on-site soils is limited to an infrequent site worker. Future scenarios include the industrial worker, construction worker, trespasser and day care receptors.

The soil data collected from the Remedial Investigation were compiled and the EPCs were calculated for each compound. For the current site worker, industrial worker, future trespasser and day care center exposures, only surface soil data collected from the 0 to 0.5 foot interval were used in this analysis. For the construction worker exposure, all soil data were used as it is assumed that the construction worker will engage in intrusive activities.

The equation for intake is as follows (EPA 1989a):

$$\textbf{Intake (mg/kg-day)} = \frac{\mathbf{CS \times IR \times CF \times FI \times EF \times ED}}{\mathbf{BW \times AT}}$$

Where:

CS = Chemical Concentration in Soil (mg/kg soil)
IR = Ingestion Rate (mg soil/day)
CF = Conversion Factor (1 Kg/10^6 mg)
FI = Fraction Ingested from Contaminated Source (unitless)
EF = Exposure Frequency (days/years)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT = Averaging Time (period over which exposure is averaged -- days)

The results of these calculations are shown in Tables J-4 through J-5.

7.3.5.5 Dermal Contact with Soils

The same receptors considered to have the potential to ingest soil may also contact the same soils dermally. These receptors include the current site worker and all future receptors.

As with the soil ingestion scenarios, the chemical concentration of the soils were taken from the 0 to 0.5 foot depth and used as the exposure point concentrations for the site worker, future industrial worker, trespasser, and day care center exposures, while the chemical concentration of all soils was used as the exposure point concentration for the construction worker scenario.

The equation for the absorbed dose from dermal exposure is as follows, based on guidance in USEPA 1992:

$$\textbf{Absorbed Dose (mg/kg-day)} = \frac{\mathbf{CS \times CF \times AF \times ABS \times SA \times EF \times ED}}{\mathbf{BW \times AT}}$$

Where:

CS = Chemical Concentration in Soil (mg/kg soil)
CF = Conversion Factor (10^{-6} kg/mg)
AF = Soil to Skin Adherence Factor (mg/cm^2)
ABS = Absorption Factor (unitless)
SA = Skin Surface Area Available for Contact (cm^2)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT = Averaging Time (period over which exposure is averaged -- days)

The product of the terms CS, AF, and ABS represents the absorbed dose per event as defined in the USEPA 1992 guidance.

The exposure calculations are summarized in Tables J-6 and J-7.

Dermal exposure involves several unique exposure factors discussed briefly here. Specifically, the dermal exposure calculation considers the amount of exposed skin, the amount of soil which adheres to the skin and the degree to which a chemical may be adsorbed through the skin.

The surface area of exposed skin depends on the size of an individual (especially adult vs. child), clothing worn, and the specific parts of the body which may directly contact the medium of concern (typically soil, surface water, sediment or dust). USEPA recommendations were followed to select exposed skin surface areas for each scenario in this assessment.

The following assumptions regarding skin surface areas for dermal exposure, according to USEPA 1992b:

Current Site Worker, Future Industrial Worker, Future Construction Worker, and Future Day Care Center Worker The hands, legs, arms, neck and head may be exposed. These comprise approximately 25% of the total body surface area. USEPA 1992b recommends surface area values of 5800 cm^2 for the RME and 5000 cm^2 for the CT as representative of these exposed body parts.

Future Adolescent Trespasser The same body parts assumed for the workers, above, are assumed for the trespasser's exposure to soil. Based on the distribution of total body surface areas for adolescents (age 12-15), the RME value was taken as 25% of the 95th percentile value and the CT was taken as 25% of the mean value. This corresponds with values of 4625 cm^2 for the RME and 3725 cm^2 for the CT. For exposure to surface water or sediment in the drainage ditches during wading, the feet and legs were assumed to be exposed. The combined surface area of these body parts is also approximately 25% of the total body, so the same RME and CT values used for soil exposure were used for surface water exposure.

Day Care Child 25% of total body area was assumed for children age 3-6. This results in surface area exposure values of 2190 cm^2 for the RME and 1820 cm^2 for the CT.

The potential magnitude of exposure depends on the amount of soil which adheres to the exposed skin. Again, USEPA recommended soil-to-skin adherence factors were used in this assessment.

Certain chemicals may be readily absorbed through the skin while others penetrate much more slowly or not at all. In the case of solid media (soil, sediment, and dust) some chemicals may be strongly bound to the matrix which reduces its ability to absorb through the skin. Chemical-specific absorption factors as provided by USEPA were used in this assessment. USEPA Region II recommends quantifying dermal exposure for cadmium, arsenic, PCBs, dioxins/furans and pentachorophenol (others are under development) only since credible values are not available for other chemicals of concern. Of these compounds, PCBs, pentachlorophenol, arsenic and cadmium were detected in soil. For PCBs, an absorption factor (ABS) of 6 percent (0.06) was used, which is at the high end of the range recommended by EPA, 0.6 to 6 percent (EPA, 1992b). For pentachlorophenol and cadmium an absorption factor of 1% (0.01) was used, as recommended by EPA. The absorption factor for arsenic is 0.1% (0.001). No other compounds were considered quantitatively for dermal absorption in non-aqueous media for this risk assessment.

The reader should note that in the guidance document Dermal Exposure Assessment: Principles and Applications (USEPA 1992b), EPA cautions that "dermal exposure is the least well understood of the major exposure routes. Very little chemical-specific data are available, especially for soils, and the predictive techniques have not been well validated". EPA further states that dermal exposure/risk estimates have considerable uncertainty, and in some cases may be overly conservative.

7.3.5.6 Dermal Contact to Surface Water while Wading (Future)

Due to the present limited access to SEAD 17, contact with on-site surface water applies only to future receptors. Since the surface water points are seasonal, intermittent and shallow (occurring in drainage ditches at the site), only the trespasser comes into contact with this water.

The Exposure Point Concentrations (EPCs) for each chemical of concern were calculated based on all surface water data collected during the RI sampling. This results in a conservative exposure estimate since current concentrations are likely to be reduced over time.

The equation for the dermally absorbed dose is as follows (USEPA, 1992b):

$$\textbf{Absorbed Dose (mg/kg-day)} = \frac{\textbf{DA x SA x EF x ED}}{\textbf{BW x AT}}$$

Where:

DA = Absorbed Dose per event (mg/cm^2 - event)
SA = Skin Surface Area Available for Contact (cm^2)
EF = Exposure Frequency (events/year)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT = Averaging Time (period over which exposure is averaged -- days)

The exposure calculations are summarized in Tables J-8 and J-9.

The absorbed dose per event (DA) was calculated as described in EPA's "Dermal Exposure Assessment: Principles and Applications" (USEPA, 1992b).

For organics, a parameter, B is first calculated. The B value was adopted from the Bunge Model (Cleek and Bunge, 1992). This value attempts to characterize the relative contribution of each compounds specific permeability coefficient (K_P value) in the stratum corneum and the viable epidermis. The B-values for certain compounds are listed in Table 5-8 of the Dermal Exposure Assessment Manual, USEPA, 1992b. For any compounds not listed in this table, B-values are derived using the following equation:

$$B \approx \frac{Ko/w}{10{,}000}$$

where: Kow is the octanol-water partitioning coefficient (dimensionless).

Once calculated, the B value is used to calculate time conditions associated with estimates of compound breakthrough time. In accordance with the work of Cleek and Bunge, if the exposure time per event (ET) is less the breakthrough time (t*) of steady-state conditions specific to each compound, then the absorbed dose is calculated as follows:

$$\mathbf{DA = 2\ K_p\ x\ CW}\sqrt{\frac{6 \times \tau \times ET}{\pi}}\ x\ CF$$

If the exposure time is longer than t*, then the absorbed dose is calculated using:

$$\mathbf{DA_{event} = K_p\ x\ CW}\left[\frac{\mathrm{ET} + 2(1 + 3\mathrm{B})t}{1 + \mathrm{B}}\right]\ \mathrm{x\ CF}$$

where for both equations:

K_p = Dermal permeability coefficient (cm/hr)
CW = Chemical Concentration in Water (mg/l)
ET = Exposure Time (hours)
B = Bunge Model Value (unitless)
τ = Lag time (hours)
CF = volume conversion factor = 0.001 l/cm^3

The lag time (τ), is defined as the time it takes a chemical to penetrate to reach a steady-state condition during a dermal exposure in aqueous media. By properly defining the lag time, the permeability coefficient (K_P) can be more properly used in the risk calculation further reducing uncertainty. The lag time and breakthrough time (t*) for each organic compound was taken from Table 5-8 of the Dermal Exposure Assessment Manual (USEPA, 1992b).

Bis(2-ethylhexyl)phthalate was the only organic compound found in surface water. The t* value for this compound is 100 hours. The exposure time of one hour is less than this t*. Therefore, the first equation for DA, above, was used.

For inorganics, DA was calculated by:

$$\mathbf{DA = K_p \times CW \times ET \times CF}$$

In the Dermal Exposure Assessment Manual (USEPA, 1992b), USEPA recommends Dermal Permeability Coefficients (K_p) for a number of organic and inorganic chemicals. These recommended values were used in these exposure calculations.

Many inorganic compounds do not have specified recommended K_p values. In this case, K_p was assumed to be 1×10^{-3} as the default value recommended by EPA (USEPA, 1992b).

The duration of skin contact with surface water during each incident must be defined for these calculations. Based on guidance in the Dermal Exposure Assessment document, an RME Exposure Time of 1 hour/day and CT 0.5 hour/day was used. Because little data exists on potential Exposure Frequency, the assessor determined an RME value of 25 days/year and a CT value of 13 days/year. The basis for these assumptions were regional climate, availability of the surface water on the site, and available data on recreational water contact. These value are probably conservative, since the surface waters are minimal on the site and do not support recreation.

7.3.5.7 Incidental Ingestion of Sediment (future)

Ingestion of sediment is assumed to occur when the drainage ditches are dry, when the sediment could potentially be ingested in the same manner as soil. This pathway is assumed to have the same exposure frequency (EF) and exposure duration (ED) used for the surface water pathway, since ingestion of dry sediment is expected to be about as infrequent as wading in the wet drainage ditches. As with the surface water, only the future trespasser is considered for this exposure route.

The Exposure Point Concentrations (EPCs) for each chemical of concern were calculated based on all sediment data collected in the RI sampling program. This results in a conservative exposure estimate since current concentrations are likely to be reduced over time.

The chemical intake from ingestion of sediment is calculated by the same method used for ingestion of soil. The equation for intake is as follows (USEPA, 1989a):

$$\mathbf{Intake\ (mg/kg\text{-}day) = \frac{CS \times IR \times CF \times FI \times EF \times ED}{BW \times AT}}$$

Where:

CS = Chemical Concentration in Sediment (mg/kg)
IR = Ingestion Rate (mg sediment/kg)
CF = Conversion Factor (10^{-6} kg/mg)
EF = Exposure Frequency (days/years)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT = Averaging Time (period over which exposure is averaged -- days)

The results of these calculations are shown in Tables J-10 and J-11.

7.3.5.8 Dermal Exposure to Sediment while Wading (Future)

The same receptor considered to have the potential to ingest sediment may also contact the same sediment dermally. This receptor is the future trespasser.

The EPCs for dermal contact with sediment are the same ones calculated for ingestion exposure. The absorbed chemical dose from dermal contact with sediment is calculated by the same method used for soils except that CS is the Chemical Concentration is Sediment (mg/kg-sediment) rather than soil.

The results of the calculations are shown in Tables J-12 and J-13.

Similar to soil, the sediment dermal exposure calculation considers the amount of exposed skin, the amount of soil which adheres to the skin and the degree to which a chemical may be adsorbed through the skin. As with soil, this assessment followed USEPA guidance regarding the values assigned to each of these exposure parameters.

Of the compounds recommended by USEPA Region II for dermal exposure assessment (see discussion in Section 7.3.5.5), only arsenic and cadmium were detected in sediment. The same chemical-specific dermal absorption factors (ABS) used for the compounds in soil were used here. No other compounds were considered quantitatively for dermal exposure from sediment.

7.4 TOXICITY ASSESSMENT

The objective of the toxicity assessment is to weigh available evidence regarding the potential of the chemicals to cause adverse effects in exposed individuals, and to provide, where possible, an estimate of the relationship between the extent of exposure to a chemical and the increased likelihood and/or severity of adverse effects. The types of toxicity information considered in this assessment include the reference dose (RfD) and reference concentration (RfC) used to evaluate noncarcinogenic effects, and the slope factor and unit risk to evaluate carcinogenic potential. Most toxicity information used in this evaluation was obtained from the Integrated Risk Information System (IRIS). If values were not available from IRIS, the *Health Effects Assessment Summary Tables* (HEAST) (USEPA, 1994) were consulted. Finally, the USEPA Region II was consulted to provide any additional values not included in these two sources. The toxicity factors used in this evaluation are summarized in Table 7-7 for both noncarcinogenic and carcinogenic effects.

7.4.1 Noncarcinogenic Effects

For chemicals that exhibit noncarcinogenic (i.e., systemic) effects, authorities consider organisms to have repair and detoxification capabilities that must be exceeded by some critical concentration (threshold) before the health effect is manifested. For example, an organ can have a large number of cells performing the same or similar functions that must be significantly depleted before the effect on the organ is seen. This threshold view holds that a range of exposures from just above zero to some finite value can be tolerated by the organism without an appreciable risk of adverse effects.

Health criteria for chemicals exhibiting noncarcinogenic effects for use in risk assessment are generally developed using USEPA RfDs and RfCs developed by the RfD/RfC Work Group and included in the IRIS. In general, the RfD/RfC is an estimate of an average daily exposure to an individual (including sensitive individuals) below which there will not be an appreciable risk of adverse health effects. The RfD/RfC is derived using uncertainty factors (e.g., to adjust from animals to humans and to protect sensitive subpopulations) to ensure that it is unlikely to underestimate the potential for adverse noncarcinogenic effects to occur. The purpose of the RfD/RfC is to provide a benchmark against which an intake (or an absorbed dose in the case of dermal contact) from human exposure to various environmental conditions might be compared. Intakes or doses that are significantly higher that the RfD/RfC may indicate that an inadequate margin of safety could exist for exposure to that substance and that an adverse health effect could occur.

7.4.1.1 References Doses for Oral and Inhalation Exposure

The types of toxicity values used to evaluate the noncarcinogenic effects of chemicals include RfDs for oral exposure, and RfCs for inhalation exposure. RfDs and RfCs represent thresholds for toxicity. They are derived such that human lifetime exposure to a given chemical via a given route at levels at or below the RfD or RfC, as appropriate, should not result in adverse health

TABLE 7-7

TOXICITY VALUES

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Analyte	Oral RfD (mg/kg-day)		Inhalation RfD (mg/kg-day)		Carc. Slope Oral (mg/kg-day)-1		Rank Wt. of Evidence	Carc. Slope Inhalation (mg/kg-day)-1		Dermal RfD (mg/kg-day)		Carc. Slope Dermal (mg/kg-day)-1		Oral Absorption Factor	
Volatile Organics															
Acetone	1.00E-01	a	NA	e	NA	e	D	NA	e	1.00E-01	f	NA	g	1	
Benzene	3.00E-03	e	1.71E-03	e	2.90E-02	a	A	2.91E-02	a	2.85E-03	f	3.05E-02	g	0.95	
Methylene Chloride	6.00E-02	a	8.57E-01	b	7.50E-03	a	B2	1.65E-03	a	5.88E-02	f	7.65E-03	g	0.98	
Toluene	2.00E-01	a	1.14E-01	a	NA	e	D	NA	e	2.00E-01	f	NA	g	1	
Semivolatile Organics															
Dimethylphenol, 2,4-	2.00E-02	a	NA	e	NA	e	NA	NA	e	2.00E-02	f	NA	g		
Dinitrotoluene, 2,4-	2.00E-03	a	NA	a3	6.80E-01	a	B2	NA	a	2.00E-03	f	6.80E-01	g	1	
Dinitrotoluene, 2,6-	1.00E-03	b	NA	a3	6.80E-01	a	NA	NA	a	1.00E-03	f	6.80E-01	g	1	
Methylnaphthalene, 2-	4.00E-02	e	NA	e	NA	e	NA	NA	e	NA	f	NA	g	1	
Methylphenol, 2-	5.00E-02	a	NA	e	NA	e	C	NA	e	5.00E-02	f	NA	g	1	
Dichlorobenzidine, 3,3'-	NA	e	NA	e	4.50E-01	a	B2	NA	e	NA	f	4.50E-01	g	1	
Nitroaniline, 3-	NA	e	NA	e	NA	e	NA	NA	e	NA	f	NA	g	1	
Nitroaniline, 4-	NA	e	NA	e	NA	e	NA	NA	e	NA	f	NA	g	1	
Acenaphthene	6.00E-02	a	NA	e	NA	e	NA	NA	e	6.00E-02	f	NA	g	1	
Acenaphthylene	NA	e	NA	e	NA	e	D	NA	e	NA	f	NA	g	1	
Anthracene	3.00E-01	a	NA	e	NA	e	D	NA	e	3.00E-01	f	NA	g	1	
Benzo(a)anthracene	NA	e	NA	e	7.30E-01	c	B2	NA	f	NA	f	7.30E-01	g	1	
Benzo(a)pyrene	NA	e	NA	e	7.30E+00	a	B2	NA	e	NA	f	1.83E+01	g	0.4	
Benzo(b)fluoranthene	NA	e	NA	e	7.30E-01	c	B2	NA	e	NA	f	7.30E-01	g	1	
Benzo(g,h,i)perylene	NA	e	NA	e	NA	e	D	NA	e	NA	f	NA	g	1	
Benzo(k)fluoranthene	NA	e	NA	e	7.30E-02	c	B2	NA	e	NA	f	7.30E-02	g	1	
Butylbenzylphthalate	2.00E-01	b	NA	e	NA	e	C	NA	e	2.00E-01	f	NA	g	1	
Carbazole	NA	e	NA	e	2.00E-02	b	B2	NA	e	NA	f	2.00E-02	g	1	
Chrysene	NA	e	NA	e	7.30E-03	c	B2	NA	e	NA	f	7.30E-03	g	1	
Di-n-butylphthalate	1.00E-01	a	NA	e	NA	e	D	NA	e	9.00E-02	f	NA	g	0.9	
Dibenz(a,h)anthracene	NA	e	NA	e	7.30E+00	c	B2	NA	e	NA	f	7.30E+00	g	1	
Dibenzofuran	NA	e	NA	e	NA	e	D	NA	e	NA	f	NA	g	1	
Fluoranthene	4.00E-02	a	NA	e	NA	e	D	NA	e	4.00E-02	f	NA	g	1	
Fluorene	4.00E-02	a	NA	e	NA	e	D	NA	e	4.00E-02	f	NA	g	1	
Indeno(1,2,3-cd)pyrene	NA	e	NA	e	7.30E-01	c	B2	NA	e	NA	f	7.30E-01	g	1	
N-Nitroso-di-n-propylamine	NA	e	NA	e	7.00E+00	e	NA	NA	e	NA	f	7.00E+00	g	1	
Naphthalene	4.00E-02	e	NA	e	NA	e	D	NA	e	4.00E-02	f	NA	g	1	
Pentachlorophenol	3.00E-02	a	NA	e	1.20E-01	a	B2	NA	e	3.00E-02	f	1.20E-01	g	1	
Phenanthrene	NA	e	NA	e	NA	e	D	NA	e	NA	f	NA	g	1	
Pyrene	3.00E-02	a	NA	e	NA	e	NA	NA	e	3.00E-02	f	NA	g	1	
bis(2-Chloroisopropyl) ether	4.00E-02	h	NA	h	7.00E-02	h	NA	3.50E-02	h	4.00E-02	f	NA	g	1	
bis(2-Ethylhexyl)phthalate	2.00E-02	a	NA	e	1.40E-02	a	B2	NA	e	1.00E-02	f	2.80E-02	g	0.5	
Pesticides/PCBs															
DDD, 4,4'-	NA	a	NA	e	2.40E-01	a	B2	NA	e	NA	f	1.20E+00	g	0.2	
DDE, 4,4'-	NA	e	NA	e	3.40E-01	e	B2	NA	e	NA	f	1.70E+00	g	0.2	
DDT, 4,4'-	5.00E-04	a	NA	e	3.40E-01	a	B2	3.40E-01	a	1.00E-04	f	1.70E+00	g	0.2	
Aldrin	3.00E-05	a	NA	b	1.70E+01	a	B2	1.72E+01	a	1.50E-05	f	3.40E+01	g	0.5	
Aroclor-1254	2.00E-05	a	NA	a	2.00E+00	a	B2	4.00E-01	a	1.80E-05	f	2.22E+00	g	0.9	
Aroclor-1260	2.00E-05	a	NA	a	2.00E+00	a	B2	4.00E-01	a	1.80E-05	f	2.22E+00	g	0.9	
Dieldrin	5.00E-05	a	NA	e	1.60E+01	a	B2	1.61E+01	a	2.50E-05	f	3.20E+01	g	0.5	
Endosulfan I	6.00E-03	b	NA	e	NA	e	NA	NA	e	6.00E-03	f	NA	g	1	
Endosulfan II	6.00E-03	e	NA	e	NA	e	NA	NA	e	6.00E-03	f	NA	g	1	
Endosulfan sulfate	6.00E-03	b	NA	e	NA	e	NA	NA	e	6.00E-03	f	NA	g	1	
Endrin	3.00E-04	a	NA	e	NA	e	D	NA	e	3.00E-04	f	NA	g	1	
Endrin ketone	NA	e	NA	e	NA	e	NA	NA	e	NA	f	NA	g	1	
Heptachlor epoxide	1.30E-05	a	NA	e	9.10E+00	a	B2	9.10E+00	a	1.30E-05	f	9.10E+00	g	1	
alpha-Chlordane	6.00E-05	b	NA	e	1.30E+00	a	B2	1.30E+00	e	6.00E-05	f	1.30E+00	g	1	
beta-BHC	NA	e	NA	e	1.80E+00	a	C	1.86E+00	a	NA	f	1.80E+00	g	1	
delta-BHC	NA	e	NA	e	NA	e	NA	NA	e	NA	f	NA	g	1	

TABLE 7-7

TOXICITY VALUES

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Analyte	Oral RfD (mg/kg-day)		Inhalation RfD (mg/kg-day)		Carc. Slope Oral (mg/kg-day)-1		Rank Wt. of Evidence	Carc. Slope Inhalation (mg/kg-day)-1		Dermal RfD (mg/kg-day)		Carc. Slope Dermal (mg/kg-day)-1		Oral Absorption Factor
Metals														
Aluminum	1.00E+00	m	1.43E-03	m	NA	m	D	NA	m	NA	m	NA	m	0.04
Antimony	4.00E-04	b	NA	e	NA	e	NA	NA	e	4.00E-04	f	NA	g	0.01
Arsenic	3.00E-04	a	NA	e	1.50E+00	d	A	1.51E+01	a	2.40E-04	f	1.88E+00	g	0.8
Barium	7.00E-02	a	1.43E-04	b	NA	e	NA	NA	e	3.50E-03	f	NA	g	0.05
Beryllium	5.00E-03	a	NA	e	4.30E+00	a	B2	8.40E+00	a	5.00E-05	f	4.30E+02	g	0.01
Cadmium	5.00E-04	a	NA	e	NA	e	B1	6.30E+00	a	5.00E-05	f	NA	g	0.1
Calcium	NA	e	NA	e	NA	e	NA	NA	e	NA	f	NA	g	1
Chromium	5.00E-03	a	NA	e	NA	e	A	4.20E+01	a	1.00E-04	f	NA	g	1
Cobalt	NA	e	NA	e	NA	e	NA	NA	e	NA	f	NA	g	0.05
Copper	4.00E-02	b	NA	e	NA	e	D	NA	e	2.40E-02	f	NA	g	0.6
Cyanide	2.00E-02	a	NA	e	NA	e	D	NA	e	1.00E-02	f	NA	g	0.5
Iron	3.00E-01	e	NA	e	NA	e	D	NA	e	3.00E-01	f	NA	g	1
Lead	NA	e	NA	e	NA	e	B2	NA	e	NA	f	NA	g	0.15
Magnesium	NA	e	NA	e	NA	e	D	NA	e	NA	f	NA	g	1
Manganese	5.00E-02	a	1.40E-05	a	NA	e	D	NA	e	1.50E-03	f	NA	g	0.03
Mercury	3.00E-04	b	8.57E-05	b	NA	e	D	NA	e	3.00E-06	f	NA	g	0.01
Nickel	2.00E-02	a	NA	e	NA	e	A	NA	b	8.00E-04	f	NA	g	0.04
Potassium	NA	e	NA	e	NA	e	NA	NA	e	NA	f	NA	g	1
Selenium	5.00E-03	b	NA	e	NA	e	NA	NA	e	4.50E-03	f	NA	g	0.9
Silver	5.00E-03	a	NA	e	NA	e	D	NA	e	1.00E-03	f	NA	g	0.2
Sodium	NA	e	NA	e	NA	e	NA	NA	e	NA	f	NA	g	1
Thallium	8.00E-05	b	NA	e	NA	e	NA	NA	e	8.00E-05	f	NA	g	1
Vanadium	7.00E-03	b	NA	e	NA	e	D	NA	e	7.00E-05	f	NA	g	0.01
Zinc	3.00E-01	a	NA	e	NA	e	D	NA	e	7.50E-02	f	NA	g	0.25
Herbicides														
MCPA	5.00E-04	a	NA	e	NA	e	NA	NA	e	5.00E-04	f	NA	g	1

a = Taken from the Integrated Risk Information System (IRIS) (Online December 1997)
b = Taken from HEAST 1995
c = Calculated using TEF
d = Calculated from proposed oral unit risk value
e = Provided by USEPA - October 1993
f = Calculated from oral RFD value
g = Calculated from oral slope factor
i = Provisional health guideline from EPA Risk Assessment Issue Papers (1995-1996) provided by EPA Technical Support Center.
(Inhalation RfD's were derived from EPA RfC's based on the assumption of 20 m3/day inhalation rate and 70 kg body weight.)
j = Where no oral absorption efficiency data are available, EPA Region 2 recommends that no adjustment be made for relative absorption (i.e. assume oral absorption factor = 1.0)
k = Taken from ATSDR Toxicity Profiles (1989 - 1995)
l = EPA Region 2 accepted oral absorption factor for cadmium (personal communication between A. Schatz of Parsons and M. Maddaloni of EPA)
m = Provisional health guideline from EPA Risk Assessment Issue Papers (1997) provided by EPA Technical Support Center.
(Inhalation RfD's were derived from EPA RfC's based on the assumption of 20 m3/day inhalation rate and 70 kg body weight.)
NA = Not Available

effects, even for the most sensitive members of the population. The chronic RfD or RfC for a chemical is ideally based on studies where either animal or human populations were exposed to a given chemical by a given route of exposure for the major portion of the life span (referred to as a chronic study). Various effect levels may be determined in a study; however, the preferred effect level for calculating noncarcinogenic toxicity values is the no-observed-adverse-effect level, or NOAEL. Second to the NOAEL is the lowest-observed-adverse-effect level, or LOAEL.

The oral RfD is derived by determining dose-specific effect levels from all the available quantitative studies, and applying uncertainty factors and/or a modifying factor to the most appropriate effect level. Uncertainty factors are intended to account for 1) the variation in sensitivity among members of the human population, 2) the uncertainty in extrapolating animal data to humans, 3) the uncertainty in extrapolating from data obtained in a study that is less than lifetime exposure, 4) the uncertainty in using LOAEL data rather than NOAEL data, and 5) the uncertainty resulting from inadequacies in the data base. The modifying factor may be used to account for other uncertainties such as inadequacy of the number of animals in the critical study. Usually each of these uncertainty factors is set equal to 10, while the modifying factor varies between one and 10. RfDs are reported as doses in milligrams of chemical per kilogram body weight per day (mg/kg-day).

The inhalation RfC is derived by determining concentration-specific effect levels from all of the available literature and transforming the most appropriate concentration to a human RfC. Transformation usually entails converting the concentration and exposure duration used in the study to an equivalent continuous 24-hour exposure, transforming the exposure-adjusted value to account for differences in animal and human inhalation, and then applying uncertainty factors and/or a modifying factor to the adjusted human exposure concentration to arrive at an RfC. The uncertainty factors potentially used are the same ones used to arrive at an RfD (see above). RfCs are reported as concentrations in milligrams of chemical per cubic meter of air (mg/m^3). To use the RfCs in calculating risks, they were converted to inhalation reference doses in units of milligrams of chemical per kilogram of body weight per day (mg/kg/day). This conversion was made by assuming an inhalation rate of 20 m^3/day and an adult body weight of 70 kg. Thus:

$$\textbf{Inhalation Reference Dose (mg/kg/day)} = RfC\left(\frac{mg}{m^3}\right)x\left(\frac{20m^3}{day}\right)x\left(\frac{1}{70kg}\right)$$

7.4.1.2 Reference Doses for Dermal Exposure

USEPA has not derived toxicity values for all routes of exposure. Most of the available toxicity values are for oral exposure. Many inhalation values are also available. No values are currently available for dermal exposure. This is due to the lack of scientific studies available to quantify dermal toxicity and carcinogenic potential for the vast majority of priority pollutants. In addition, until recently, scientists have assumed that the hazards due to dermal exposures were minimal in comparison with those due to oral exposure. However, it appears that in many instances the hazards due to dermal exposure may be as great or greater.

In the absence of dermal reference toxicity values, USEPA has suggested (USEPA, 1989a) that in some cases it is appropriate to modify an oral RfD so it can be used to estimate the hazard incurred by dermal exposure. This requires that the toxic endpoints observed are the same for both oral and dermal exposure, and that one have quantitative estimates of both dermal and oral absorption of the chemical. This information is not available for most priority pollutants, and oral toxicity values are nevertheless often used to quantify risks associated with dermal exposure. As a consequence, any valuation of the contribution of dermal exposure to the overall hazard needs to be viewed as highly tentative at best.

USEPA RAGS (1989a) provides guidance for use of oral toxicity values in determining dermal toxicity. RfDs are expressed as the amount of substance administered per unit time and unit body weight (administered-dose), whereas exposure estimates for the dermal route of exposure are expressed as the amount of substance absorbed into the body per unit time and unit body weight (absorbed-dose). Thus, for dermal exposure to contaminants in water or in soil, it is necessary to adjust an oral toxicity value from an administered to an absorbed dose. Where oral absorption efficiencies were available, the oral RfD was converted to a dermal RfD by multiplying by oral absorption efficiency. Oral absorption factors and the calculated dermal RfDs are shown in Table 7-7.

In the absence of any information on absorption for the substance or chemically related substances, an oral absorption efficiency of 100 percent was assumed in accordance with USEPA Region 2 guidance (personal communication between A. Schatz of Parsons and M. Maddeloni of EPA Region 2).

7.4.1.3 Exposure Periods

As mentioned earlier, chronic RfDs and RfCs are intended to be set at levels such that human lifetime exposure at or below these levels should not result in adverse health effects, even for the most sensitive members of the population. These values are ideally based on chronic exposure studies in humans or animals. Chronic exposure for humans is considered to be exposure of roughly seven years or more, based on exposure of rodents for one year or more in animal toxicity studies. For children, trespassers, and construction workers, chronic RfDs and RfCs were used to conservatively assess risks for shorter exposure periods.

7.4.2 Health Criteria for Carcinogenic Effects

For chemicals that exhibit carcinogenic effects, most authorities recognize that one or more molecular events can evoke changes in a single cell or a small number of cells that can lead to tumor formation. This is the non-threshold theory of carcinogenesis which purports that any level of exposure to a carcinogen can result in some finite possibility of generating the disease. Generally, regulatory agencies assume the non-threshold hypothesis for carcinogens in the absence of information concerning the mechanisms of action for the chemical of concern.

USEPA's Carcinogen Risk Assessment Verification Endeavor (CRAVE) has developed slope factors and unit risks (i.e., dose-response values) for estimating excess lifetime cancer risks associated with various levels of lifetime exposure to potential human carcinogens. The carcinogenic slope factors can be used to estimate the lifetime excess cancer risk associated with exposure to a potential carcinogen. Risks estimated using slope factors are considered unlikely to underestimate actual risks, but they may overestimate actual risks. Excess lifetime cancer risks are generally expressed in scientific notation. An excess lifetime cancer risk of 1×10^{-6} (one in a million), for example, represents the probability of an individual developing cancer over a lifetime as a result of exposure to the specific carcinogenic chemical. USEPA considers total excess lifetime cancer risks within the range of 10^{-4} (one in ten thousand) to 10^{-6} (USEPA, 1989a) to be acceptable when developing remedial alternatives for cleanup of Superfund Sites.

In practice, slope factors are derived from the results of human epidemiology studies or chronic animal bioassays. The data from animals studies are fitted to the linearized, multistage model and a dose-response curve is obtained. The upper limit of the 95th percentile confidence-interval slope of the dose-response curve is subjected to various adjustments, and an interspecies scaling factor is applied to conservatively derive the slope factor for humans. This linearized multistage procedure leads to a plausible upper limit of the risk that is consistent with some proposed mechanisms of carcinogenesis. Thus, the actual risks associated with exposure to a potential carcinogen are not likely to exceed the risks estimated using these slope factors, but they may be much lower. Dose-response data derived from human epidemiological studies are fitted to dose-time-response curves on an ad-hoc basis. These models provide rough but plausible estimates of the upper limits on lifetime risk. Slope factors based on human epidemiological data are also derived using very conservative assumptions and, as such, are considered unlikely to underestimate risks. In summary, while the actual risks associated with exposures to potential carcinogens are unlikely to be higher than the risks calculated using a slope factor, they could be considerably lower.

In addition, there are varying degrees of confidence in the weight of evidence for carcinogenicity of a given chemical. The USEPA system involves characterizing the overall weight of evidence for a chemical's carcinogenicity based on availability of animal, human, and other supportive data. The weight-of-evidence classification is an attempt to determine the likelihood that the agent is a human carcinogen, and thus qualitatively affects the estimation of potential health risks. Three major factors are considered in characterizing the overall weight of evidence for carcinogenicity: (1) the quality of evidence from human studies, (2) the quality of evidence from animal studies, which are combined into a characterization of the overall weight of evidence for human carcinogenicity; and (3) other supportive information which is assessed to determine whether the overall weight of evidence should be modified. USEPA's final classification of the overall weight of evidence includes the following five categories:

Group A - Human Carcinogen - There is sufficient evidence from epidemiological studies to support a causal association between an agent and cancer.

Group B - Probable Human Carcinogen - There is at least limited evidence from epidemiological studies of carcinogenicity to humans (Group B1) or that, in the absence of adequate data on humans, there is sufficient evidence of carcinogenicity in animals (Group B2).

Group C - Possible Human Carcinogen - There is limited evidence of carcinogenicity in animals in the absence of data on humans.

Group D - Not Classified - The evidence for carcinogenicity in animals is inadequate.

Group E - No Evidence of Carcinogenicity to Humans - There is no evidence for carcinogenicity in at least two adequate animal tests in different species, or in both epidemiological and animal studies.

Slope factors and unit risks are developed by the USEPA based on epidemiological or animal bioassay data for a specific route of exposure, either oral or inhalation. For some chemicals, sufficient data are available to develop route-specific slope factors for inhalation and ingestion. For chemicals with only one route-specific slope factor but for which carcinogenic effects may also occur via another route, the available slope factor may be used by the USEPA to evaluate risks associated with several potential routes of exposure (USEPA, 1989b).

A number of the chemicals of potential concern have been classified as carcinogens or potential carcinogens by USEPA, and each of these has also been assigned a carcinogenicity weight-of-evidence category as shown in Table 7-7. These chemicals are:

Group A - Human Carcinogens

Arsenic
Benzene
Chromium VI
Nickel

Group B - Probable Human Carcinogens

Methylene Chloride
2,4-Dinitrotoluene
3,3'-Dichlorobenzidine
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Carbazole
Chrysene
Dibenz(a,h)anthracene
Indeno(1,2,3-cd)pyrene
Pentachlorophenol
bis(2-Ethylhexyl)phthalate
DDE, 4,4'-
DDD, 4,4'-
DDT, 4,4'-
Aldrin
Aroclor -1254
Aroclor-1260
Dieldrin
Heptachlor epoxide
alpha-Chlordane
Beryllium
Cadmium
Lead

Group C - Possible Human Carcinogens

2-Methylphenol
Butylbenzylphthalate
beta-BHC

All remaining chemicals of concern are either not found to have weight of evidence rankings or are Group D or E. Group D classification means that the data are insufficient to make a determination regarding carcinogenic potential while Group E compounds have been conclusively found to be non-carcinogenic. Chemicals of potential concern found at SEAD 17 with potential carcinogenic effects are shown in Table 7-7 along with their cancer slope factors.

7.4.2.1 Cancer Slope Factors for Oral and Inhalation Exposure

The types of toxicity values used to evaluate the carcinogenic effects of chemicals include slope factors (SFs) for oral exposure, and unit risk factors (URFs) for inhalation exposure. Oral slope factors are reported as risk per dose $(mg/kg\text{-}day)^{-1}$. Inhalation unit risk factors are reported in units of risk per concentration $(mg/m^3)^{-1}$. To make use of the unit risk factors in calculating risks they first had to be converted to inhalation slope factors in units of $(mg/kg\text{-}day)^{-1}$. This conversion was made by assuming an inhalation rate of 20 m^3/day and an adult bodyweight of 70 kg. Thus:

Inhalation slope factor $(mg/kg\text{-}day)^{-1}$

$$UnitRisk\left(\frac{ug}{m^3}\right)^{-1} \times \frac{day}{20m^3} \times 70kg \times \frac{1000ug}{mg}$$

7.4.2.2 Cancer Slope Factors for Dermal Exposure

As discussed above, USEPA has not derived toxicity values for the dermal route of exposure. In the absence of dermal reference toxicity values, USEPA has suggested (USEPA, 1989a) that, in some cases, it is appropriate to modify an oral slope factor so it can be used to estimate the risk incurred by dermal exposure. The oral slope factors were converted to dermal slope factors by dividing by the oral absorption efficiency. The same values presented in Section 6.4.1.2 were used, however, if chemical specific modification factors were unavailable, oral values are used without adjustment. As discussed previously any valuation of the contribution of dermal exposure to the overall risk needs to be viewed as highly tentative at best. This is particularly true for PAH's which are carcinogens at the point of contact, i.e., to skin.

7.4.2.3 Toxic Equivalency Factors

When slope factors and unit risks were not available for all potentially carcinogenic members of a chemical class, toxicity values were calculated using toxicity equivalency factors (TEFs). TEFs are values that compare the carcinogenic potential of a given chemical in a class to the carcinogenic potential of a chemical in the class that has a verified slope factor and/or unit risk. USEPA has provided TEFs for PAHs (USEPA, 1993b). TEF values are as follows:

PAH	TEF
Benzo(a)pyrene	**1.0**
Benzo(a)anthracene	**0.1**
Benzo(b)fluoranthene	**0.1**
Benzo(k)fluoranthene	**0.01**
Dibenzo(a,h)anthracene	**1.0**
Chrysene	**0.001**
Indeno(1,2,3-cd)pyrene	**0.1**

To calculate a slope factor or unit risk for a given PAH the appropriate TEF value is multiplied by the slope factor or unit risk for benzo(a)pyrene.

7.5 RISK CHARACTERIZATION

7.5.1 Introduction

To characterize risk, toxicity and exposure assessments were summarized and integrated into quantitative and qualitative expressions of risk. To characterize potential noncarcinogenic effects, comparisons were made between projected intakes of substances and toxicity values. To characterize potential carcinogenic effects, probabilities that an individual will develop cancer over a lifetime of exposure were estimated from projected intakes and chemical-specific dose-response information. Major assumptions, scientific judgments, and, to the extent possible, estimates of the uncertainties embodied in the assessment are also presented.

7.5.1.1 Noncarcinogenic Effects

The potential for noncarcinogenic effects is evaluated by comparing the intake or dose calculated for an exposure scenario with an RfD derived for a similar exposure period. This ratio, or Hazard Quotient, is defined by the following equation:

$$\textit{Noncancer Hazard Quotient} = E/RfD$$

Where:

E = Exposure level or intake (mg/kg-day), and
RfD = Reference Dose (mg/kg-day)

The noncancer hazard quotient assumes that there is a level of exposure (i.e., an RfD) below which it is unlikely for even sensitive populations to experience adverse health effects. If the exposure level (E) exceeds the threshold (i.e., If E/RfD exceeds unity) there may be concern for potential noncancer effects.

To assess the overall potential for noncarcinogenic effects posed by more than one chemical, a hazard index (HI) approach has been developed by the USEPA. This approach assumes that simultaneous sub-threshold exposures to several chemicals could result in an adverse health effect. It also assumes that the magnitude of the adverse effect will be proportional to the sum of the ratios of the subthreshold exposures to respective acceptable exposures.

This is expressed as:

$$HI = E_1/RfD_1 + E_2/RfD_2 + ... + E_i/RfD_i$$

Where:

E_i = the exposure level or intake of the ith toxicant, and
RfD_i = reference dose for the i^{th} toxicant.

While any single chemical with an exposure level greater that the toxicity value will cause the HI to exceed unity, for multiple chemical exposures, the HI can also exceed unity even if no single chemical exposure exceeds its RfD. The assumption of dose additivity reflected in the HI is best applied to compounds that induce the same effects by the same mechanisms. Applying the HI to cases where the known compounds do not induce the same effect may overestimate the potential for effects. To assess the overall potential for noncarcinogenic effects posed by several exposure pathways, the total HI for chronic exposure is the sum of the HI's for each pathway, for each receptor.

7.5.1.2 Carcinogenic Effects

For carcinogens, risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the potential carcinogen (i.e., excess individual lifetime cancer risk). The slope factor converts estimated daily intakes averaged over a lifetime of exposure directly to incremental risk of an individual developing cancer. It can generally be assumed that the dose-response relationship will be linear in the low-dose portion of the multistage model dose-response curve. Under this assumption, the slope factor is a constant, and risk will be directly related to intake. Thus, the following linear low-dose equation was used in this assessment:

$$Risk = CDI \times SF$$

Where:

Risk = A unitless probability of an individual developing cancer,
CDI = Chronic Daily Intake over 70 years (mg/kg-day), and
SF = Slope Factor $(\text{mg/kg-day})^{-1}$

Because the slope factor is typically an upper 95th-percentile confidence limit of the probability of a response based on animal data used in the multistage model, the carcinogenic risk will generally be an upper-bound estimate. This means that the true risk is not likely to exceed the risk estimate derived through this model and is likely to be less than predicted.

For simultaneous exposure to several carcinogens, the USEPA assumes that the risks are additive. That is to say:

$$\text{Risk}_T = \text{Risk1} + \text{Risk2} + \ldots + \text{Risk}_i$$

Where:

Risk_T = Total cancer risk, expressed as a unitless probability, and
Risk_i = Risk estimate for the ith substance.

Addition of the carcinogenic risks is valid when the following assumptions are met:

- doses are low,
- no synergistic or antagonistic interactions occur, and
- similar endpoints are evaluated.

According to guidance in the National Contingency Plan, the target overall lifetime carcinogenic risks from exposures for determining clean-up levels should range from 10^{-4} to 10^{-6}.

7.5.1.3 Tentatively Identified Compounds

Tables in Section 4 illustrate all TICs found during the Phase I and ESI programs at SEAD 17. VOC and semivolatile organic analyses of soil, sediment and surface water samples included tentatively identified compounds (TICs). While VOC TICs were found sporadically, semivolatile TICs were consistently found in soil and sediment at total concentrations which often exceeded the total TCL compounds. The TICs consist primarily of unknown compounds and compounds not known to be toxic. It is likely that there is some risk added by the TICs at the site, but this risk is likely not significant when compared to the risk presented by the TCL chemicals.

7.5.2 Summary of Cancer and Noncancer Risks

Tables 7-8 and 7-9 summarize the calculated cancer and noncancer risks for all exposure scenarios considered in this risk assessment. Table 7-8 summarizes the reasonable maximum exposure (RME) scenarios and Table 7-9 summarizes the central tendency (CT) scenarios. The risk calculations for each exposure scenario and exposure route are discussed in the following sections. Tables 7-8 and 7-9 also serve as a guide to tables in Appendix J which show risk calculations for each exposure route.

7.5.3 Current Site Worker

Potential health risks were estimated for the current site worker for exposures via inhalation of ambient air, ingestion of soil and dermal contact with soil. Cancer and non-cancer risk estimates are presented individually for these pathways in Appendix J. Risks from each exposure pathway are discussed below, followed by an overall summary for this scenario.

Inhalation of Particulates in Ambient Air

The cumulative cancer risk from inhalation of airborne particulates is 7×10^{-9} and 1×10^{-9} for the RME and CT, respectively. The non-cancer hazard index is 0.0001 and 0.00007 for the RME and CT, respectively. These risks for non-cancer and carcinogenic health effects are below the USEPA defined targets.

Ingestion of Soil

The cumulative cancer risk from ingestion of soil is 4×10^{-7} and 3×10^{-8} for the RME and CT, respectively. The non-cancer hazard index is 0.006 and 0.001 for the RME and CT, respectively. These risks for non-cancer and carcinogenic health effects are below the USEPA defined targets.

TABLE 7-8

CALCULATION OF TOTAL NONCARCINOGENIC AND CARCINOGENIC RISKS
REASONABLE MAXIMUM EXPOSURE (RME)
SEAD-17 Remedial Investigation
Seneca Army Depot Activity

RECEPTOR	EXPOSURE ROUTE	EXPOSURE/RISK CALCULATIONS Table Number	HAZARD INDEX	CANCER RISK
CURRENT SITE WORKER	**Inhalation of Dust in Ambient Air**	Table J-2	**1E-04**	**7E-09**
	Ingestion of Onsite Soils	Table J-4	**6E-03**	**4E-07**
	Dermal Contact to Onsite Soils	Table J-6	**5E-04**	**3E-08**
	TOTAL RECEPTOR RISK (Nc & Car)		***7E-03***	***5E-07***
FUTURE INDUSTRIAL WORKER	**Inhalation of Dust in Ambient Air**	Table J-2	**2E-03**	**9E-08**
	Ingestion of Onsite Soils	Table J-4	**7E-02**	**5E-06**
	Dermal Contact to Onsite Soils	Table J-6	**6E-03**	**3E-07**
	TOTAL RECEPTOR RISK (Nc & Car)		***8E-02***	***6E-06***
FUTURE ON-SITE CONSTRUCTION WORKERS	**Inhalation of Dust in Ambient Air**	Table J-2	**2E-02**	**3E-08**
	Ingestion of Onsite Soils	Table J-4	**3E-01**	**1E-06**
	Dermal Contact to Onsite Soils	Table J-6	**1E-02**	**2E-08**
	TOTAL RECEPTOR RISK (Nc & Car)		***3E-01***	***1E-06***
FUTURE TRESSPASSER	**Inhalation of Dust in Ambient Air**	Table J-2	**7E-05**	**6E-10**
	Ingestion of Onsite Soils	Table J-4	**4E-02**	**6E-07**
	Dermal Contact to Onsite Soils	Table J-6	**1E-03**	**1E-08**
	Dermal Contact to Surface Water while Wading	Table J-8	**1E-03**	**1E-08**
	Ingestion of Onsite Sediment	Table J-10	**5E-02**	**3E-07**
	Dermal Contact to Sediment while Wading	Table J-12	**3E-03**	**5E-09**
	TOTAL RECEPTOR RISK (Nc & Car)		***1E-01***	***9E-07***
FUTURE DAY CARE CENTER CHILD	**Inhalation of Dust in Ambient Air**	Table J-2	**4E-03**	**4E-08**
	Ingestion of Onsite Soils	Table J-4	**7E-01**	**1E-05**
	Dermal Contact to Onsite Soils	Table J-6	**1E-02**	**1E-07**
	TOTAL RECEPTOR RISK (Nc & Car)		***7E-01***	***1E-05***
FUTURE DAY CARE CENTER WORKER	**Inhalation of Dust in Ambient Air**	Table J-2	**2E-03**	**7E-08**
	Ingestion of Onsite Soils	Table J-4	**7E-02**	**5E-06**
	Dermal Contact to Onsite Soils	Table J-6	**6E-03**	**3E-07**
	TOTAL RECEPTOR RISK (Nc & Car)		***8E-02***	***6E-06***

TABLE 7-9

CALCULATION OF TOTAL NONCARCINOGENIC AND CARCINOGENIC RISKS
CENTRAL TENDENCY (CT)
SEAD-17 Remedial Investigation
Seneca Army Depot Activity

RECEPTOR	EXPOSURE ROUTE	EXPOSURE/RISK CALCULATIONS Table Number	HAZARD INDEX	CANCER RISK
CURRENT SITE WORKER	**Inhalation of Dust in Ambient Air**	Table J-3	**7E-05**	**1E-09**
	Ingestion of Onsite Soils	Table J-5	**1E-03**	**3E-08**
	Dermal Contact to Onsite Soils	Table J-7	**4E-05**	**6E-10**
	TOTAL RECEPTOR RISK (Nc & Car)		*2E-03*	*3E-08*
FUTURE INDUSTRIAL WORKER	**Inhalation of Dust in Ambient Air**	Table J-3	**2E-03**	**2E-08**
	Ingestion of Onsite Soils	Table J-5	**3E-02**	**6E-07**
	Dermal Contact to Onsite Soils	Table J-7	**9E-04**	**1E-08**
	TOTAL RECEPTOR RISK (Nc & Car)		*4E-02*	*7E-07*
FUTURE ON-SITE CONSTRUCTION WORKERS	**Inhalation of Dust in Ambient Air**	Table J-3	**1E-02**	**3E-08**
	Ingestion of Onsite Soils	Table J-5	**7E-02**	**2E-07**
	Dermal Contact to Onsite Soils	Table J-7	**2E-03**	**2E-09**
	TOTAL RECEPTOR RISK (Nc & Car)		*8E-02*	*2E-07*
FUTURE TRESSPASSER	**Inhalation of Dust in Ambient Air**	Table J-3	**3E-05**	**6E-11**
	Ingestion of Onsite Soils	Table J-5	**1E-02**	**3E-08**
	Dermal Contact to Onsite Soils	Table J-7	**1E-04**	**2E-10**
	Dermal Contact to Surface Water while Wading	Table J-9	**6E-04**	**1E-09**
	Ingestion of Onsite Sediment	Table J-11	**1E-02**	**1E-08**
	Dermal Contact to Sediment while Wading	Table J-13	**3E-04**	**9E-11**
	TOTAL RECEPTOR RISK (Nc & Car)		*3E-02*	*4E-08*
FUTURE DAY CARE CENTER CHILD	**Inhalation of Dust in Ambient Air**	Table J-3	**3E-03**	**2E-08**
	Ingestion of Onsite Soils	Table J-7	**3E-01**	**3E-06**
	Dermal Contact to Onsite Soils	Table J-9	**2E-03**	**1E-08**
	TOTAL RECEPTOR RISK (Nc & Car)		*3E-01*	*3E-06*
FUTURE DAY CARE CENTER WORKER	**Inhalation of Dust in Ambient Air**	Table J-3	**1E-03**	**2E-08**
	Ingestion of Onsite Soils	Table J-7	**3E-02**	**6E-07**
	Dermal Contact to Onsite Soils	Table J-9	**9E-04**	**1E-08**
	TOTAL RECEPTOR RISK (Nc & Car)		*3E-02*	*7E-07*

Dermal Contact with Soil

The cumulative cancer risk from dermal contact with soil is 3×10^{-8} and 6×10^{-10} for the RME and CT, respectively. The non-cancer hazard index is 0.0005 and 0.00004 for the RME and CT, respectively. These risks for non-cancer and carcinogenic health effects are below the USEPA defined targets.

Current Site Worker Summary

The cumulative lifetime cancer risk from all pathways is 5×10^{-7} (RME) and 3×10^{-8} (CT). These risks are below the USEPA target range of 10^{-6} to 10^{-4}. The cumulative non-cancer hazard index from all pathways is 0.007 (RME) and 0.002 (CT). This hazard index is also below the USEPA target of 1.0.

7.5.4 Future Industrial Worker

Potential health risks were estimated for the future industrial worker for exposures via inhalation of ambient air, ingestion of soil and dermal contact with soil. Cancer and non-cancer risk estimates are presented individually for these pathways in Appendix J. Risks from each exposure pathway are discussed below, followed by an overall summary for this scenario.

Inhalation of Particulates in Ambient Air

The cumulative cancer risk from inhalation of airborne particulates is 9×10^{-8} (RME) and 2×10^{-8} (CT). The non-cancer hazard index is 0.002 for both the RME and CT. These risks for non-cancer and carcinogenic health effects are below the USEPA defined targets.

Ingestion of Soil

The cumulative cancer risk from ingestion of soil is 5×10^{-6} and 6×10^{-7} for the RME and CT, respectively. The non-cancer hazard index is 0.07 and 0.03 for the RME and CT, respectively. These risks for non-cancer and carcinogenic health effects are below the USEPA defined targets.

Dermal Contact with Soil

The cumulative cancer risk from dermal contact with soil is 3×10^{-7} and 1×10^{-8} for the RME and CT, respectively. The non-cancer hazard index is 0.006 and 0.0009 for the RME and CT, respectively. These risks for non-cancer and carcinogenic health effects are below the USEPA defined targets.

Future Industrial Worker Summary

The cumulative lifetime cancer risk from all pathways is 6 x 10^{-6} (RME) and 7 x 10^{-7} (CT). These risks are within or below the USEPA target range of 10^{-6} to 10^{-4}. The cumulative non-cancer hazard index from all pathways is 0.08 (RME) and 0.04 (CT). This hazard index is also below the USEPA target of 1.0.

7.5.5 Future Construction Worker

Potential health risks were estimated for the future construction worker for exposures via inhalation of ambient air, ingestion of soil and dermal contact with soil. Cancer and non-cancer risk estimates are presented individually for these pathways in Appendix J. Risks from each exposure pathway are discussed below, followed by an overall summary for this scenario.

Inhalation of Particulates in Ambient Air

The cumulative cancer risk from inhalation of airborne particulates is 3 x 10^{-8} for both the RME and CT. The non-cancer hazard index is 0.02 and 0.01 for the RME and CT, respectively. These risks for non-cancer and carcinogenic health effects are below the USEPA defined targets.

Ingestion of Soil

The cumulative cancer risk from ingestion of soil is 1 x 10^{-6} and 2 x 10^{-7} for the RME and CT, respectively. The non-cancer hazard index is 0.03 and 0.07 for the RME and CT, respectively. These risks for non-cancer and carcinogenic health effects are below the USEPA defined targets.

Dermal Contact with Soil

The cumulative cancer risk from dermal contact with soil is 2 x 10^{-8} and 2 x 10^{-9} for the RME and CT, respectively. The non-cancer hazard index is 0.01 and 0.002 for the RME and CT, respectively. These risks for non-cancer and carcinogenic health effects are below the USEPA defined targets.

Future Construction Worker Summary

The cumulative lifetime cancer risk from all pathways is 1 x 10^{-6} (RME) and 2 x 10^{-7} (CT). These risks are within or below the USEPA target range of 10^{-6} to 10^{-4}. The cumulative non-cancer hazard index from all pathways is 0.3 (RME) and 0.08 (CT). The hazard index is also below the USEPA target of 1.0.

7.5.6 Future Trespasser

Potential health risks were estimated for the future adolescent trespasser for exposures via inhalation of ambient air, ingestion of surface soil, dermal contact with surface soil, ingestion of surface water, dermal contact with surface water, ingestion of sediment, and dermal contact with sediment. Cancer and non-cancer risk estimates are presented individually for these pathways in Appendix J. Risks from each exposure pathway are discussed below, followed by an overall summary for this scenario.

Inhalation of Particulates in Ambient Air

The cumulative cancer risk from inhalation of airborne particulates is 6×10^{-10} and 6×10^{-11} for the RME and CT, respectively. The non-cancer hazard index is 0.00007 and 0.00003 for the RME and CT, respectively. These risks for non-cancer and carcinogenic health effects are below the USEPA defined targets.

Ingestion of Soil

The cumulative cancer risk from ingestion of surface soil is 6×10^{-7} and 3×10^{-8} for the RME and CT, respectively. The non-cancer hazard index is 0.04 and 0.01 for the RME and CT, respectively. These risks for non-cancer and carcinogenic health effects are below the USEPA defined targets.

Dermal Contact with Soil

The cumulative cancer risk from dermal contact with surface soil is 1×10^{-8} and 2×10^{-10} for the RME and CT, respectively. The non-cancer hazard index is 0.001 and 0.0001 for the RME and CT, respectively. These risks for non-cancer and carcinogenic health effects are below the USEPA defined targets.

Dermal Contact with Surface Water

The cumulative cancer risk from dermal contact with surface water is 1×10^{-8} and 1×10^{-9} for the RME and CT, respectively. The non-cancer hazard index is 0.001 and 0.0006 for the RME and CT, respectively. These risks for non-cancer and carcinogenic health effects are below the USEPA defined targets.

Ingestion of Sediment

The cumulative cancer risk from ingestion of sediment is 3 x 10^{-7} and 1 x 10^{-8} for the RME and CT, respectively. The non-cancer hazard index is 0.05 and 0.01 for the RME and CT, respectively. These risks for non-cancer and carcinogenic health effects are below the USEPA defined targets.

Dermal Contact with Sediment

The cumulative cancer risk from dermal contact with sediment is 5 x 10^{-9} and 9 x 10^{-11} for the RME and CT, respectively. The non-cancer hazard index is 0.003 and 0.0003 for the RME and CT, respectively. These risks for non-cancer and carcinogenic health effects are below the USEPA defined targets.

Future Trespasser Summary

The cumulative lifetime cancer risk from all pathways is 9 x 10^{-7} (RME) and 4 x 10^{-8} (CT). These risks are below the USEPA target range of 10^{-6} to 10^{-4}. The cumulative non-cancer hazard index from all pathways is 0.1 (RME) and 0.03 (CT). This hazard index is also below the USEPA target of 1.0.

7.5.7 Future Day Care Center Child

Potential health risks were estimated for the future day care center child for exposures via inhalation of ambient air, ingestion of soil, and dermal contact with soil. Cancer and non-cancer risk estimates are presented individually for these pathways in Appendix J. Risks from each exposure pathway are discussed below, followed by an overall summary for this scenario.

Inhalation of Particulates in Ambient Air

The cumulative cancer risk from inhalation of airborne particulates is 4 x 10^{-8} and 2 x 10^{-8} for the RME and CT, respectively. The non-cancer hazard index is 0.004 and 0.003 for the RME and CT, respectively. These risks for carcinogenic and non-cancer health effects are below USEPA defined targets.

Ingestion of Soil

The cumulative cancer risk from ingestion of soil is 1 x 10^{-5} and 3 x 10^{-6} for the RME and CT, respectively. The non-cancer hazard index is 0.7 and 0.3 for the RME and CT, respectively. These risks for carcinogenic and non-cancer health effects are below USEPA defined targets.

Dermal Contact with Soil

The cumulative cancer risk from dermal contact with soil is 1 x 10^{-7} and 1 x 10^{-8} for the RME and CT, respectively. The non-cancer hazard index is 0.02 and 0.002 for the RME and CT, respectively. These risks for carcinogenic and non-cancer health effects are below USEPA defined targets.

Future Day Care Center Child Summary

The cumulative lifetime cancer risk from all pathways is 1 x 10^{-5} (RME) and 3 x 10^{-6} (CT). These risks are within the USEPA target range of 10^{-6} to 10^{-4}. The cumulative non-cancer hazard index from all pathways is 0.7 (RME) and 0.3 (CT). This hazard index is also below the USEPA target of 1.0.

7.5.8 Future Day Care Center Worker

Potential health risks were estimated for the future day care center worker for exposures via inhalation of ambient air, ingestion of soil, and dermal contact with soil. Cancer and non-cancer risk estimates are presented individually for these pathways in Appendix J. Risks from each exposure pathway are discussed below, followed by an overall summary for this scenario.

Inhalation of Particulates in Ambient Air

The cumulative cancer risk from inhalation of airborne particulates is 7 x 10^{-8} and 2 x 10^{-8} for the RME and CT, respectively. The non-cancer hazard index is 0.002 and 0.001 for the RME and CT, respectively. These risks for carcinogenic and non-cancer health effects are below USEPA defined targets.

Ingestion of Soil

The cumulative cancer risk from ingestion of soil is 5 x 10^{-6} and 6 x 10^{-7} for the RME and CT, respectively. The non-cancer hazard index is 0.07 and 0.03 for the RME and CT, respectively. These risks for carcinogenic and non-cancer health effects are below USEPA defined targets.

Dermal Contact with Soil

The cumulative cancer risk from dermal contact with soil is 7 x 10^{-8} and 2 x 10^{-8} for the RME and CT, respectively. The non-cancer hazard index is 0.006 and 0.0009 for the RME and CT, respectively. These risks for carcinogenic and non-cancer health effects are below USEPA defined targets.

Future Day Care Center Worker Summary

The cumulative lifetime cancer risk from all pathways is 6 x 10^{-6} (RME) and 7 x 10^{-7} (CT). These risks are within the USEPA target range of 10^{-6} to 10^{-4}. The cumulative non-cancer hazard index from all pathways is 0.08 (RME) and 0.03 (CT). This hazard index is also below the USEPA target of 1.0.

7.5.9 Risk Characterization for Lead

The previous analyses of the current and future land use exposure scenarios do not include any quantification of risk for lead since no approved RfD, RfC, slope factor or inhalation unit risk currently are available. Lead was consistently detected at SEAD-17 in all media. This section qualitatively addresses the risk from lead exposure at SEAD-17.

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, which are not part of the current site users. Young and developing humans are highly sensitive to its effects. Also, young children are prone to ingest more lead as a result of normal mouthing behavior. Decreased IQ and reduced growth may result from childhood exposure. Fetal exposure may result in preterm birth, reduced birth weight, and decreased IQ. Some of the health effects of lead, particularly changes in the levels of certain blood enzymes and in aspects of children's neurobehavioral development, may occur at blood levels so low as to be essentially without a threshold.

Lead exposures 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 to the male reproductive system. The USEPA currently does not provide any toxicity values for lead. The USEPA has placed lead in weight-of-evidence Group B2, indicating that it is a probable human carcinogen.

USEPA has developed different approaches for assessing risks from adult and child exposure to lead. To address adult exposures, EPA issued "Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil" (USEPA, December 1996). To address child exposures, EPA recommends use of the Integrated Exposure Uptake Biokinetic Model for Lead (Version 0.99), and the associated "Guidance Manual for the Integrated Integrated Exposure Uptake Biokinetic Model for Lead in Children" (USEPA, February 1994). The analysis of potential risk from exposure to lead at SEAD 16 follows these recommendations for adult and child exposures, respectively.

Child Day Care Center Exposure

USEPA and the Centers for Disease Control and Prevention have determined that blood lead levels as low as 10-15 ug/dL in infants or young children indicate an increased risk of irreversible neurobehavioral deficits (Federal Register, 1988). Where young children may be consistently exposed to lead, such as in a residential scenario, risk may be calculated using the Integrated Exposure Uptake Biokinetic Model (IEUBK) which predicts the blood lead concentrations in children exposed to lead through a variety of media. The model is designed to estimate blood lead levels using a combination of default assumptions and site-specific exposure information where available. The model contains two modules: uptake and biokinetic. The uptake module estimates the quantity of lead taken into the body (uptake) from exposure to lead in five media (air, drinking water, soil/dust, food and paint). The biokinetic module estimates the distribution of this lead among various bodily organs and, most importantly, in the blood.

The IEUBK model calculates a child's uptake and blood lead levels assuming a constant daily exposure in each of several environmental media (air, soil, etc.). The model includes default values for many exposure parameters which change by age, to realistically reflect growth changes in a child (e.g. different inhalation rates and drinking water intakes). The default values used in IEUBK model are based on nationwide surveys of lead distribution in the environment and studies of inhalation and ingestion for each age group modeled (children age 0-7). For the IEUBK simulations performed for this risk assessment, the default values were used for most input parameters.

The IEUBK model was used to estimate the risk associated with a child's ingestion of soil while attending a day care center located at SEAD 17. To simulate this scenario, we assumed that a child was exposed to SEAD 17 soil five days per week. The IEUBK model contains default values for soil ingestion rates based on daily (i.e., seven days per week) exposure. These values were multiplied by 5/7 to reflect exposure only at the day care center. This calculation assumes that on the other two days per week the child has no lead exposure from soil ingestion.

The IEUBK model includes default assumptions regarding indoor dust ingestion rates and lead concentrations. The IEUBK manual recommends that indoor dust be assumed to have a lead concentration equal to 70% of the soil concentration, and that soil represents 45% of the total soil plus dust ingestion rate. These default assumptions were used.

The child is potentially exposed to lead via other pathways. The IEUBK model includes default exposures for lead in air, drinking water, and diet. The recommended default values were used for all non-soil/dust exposures.

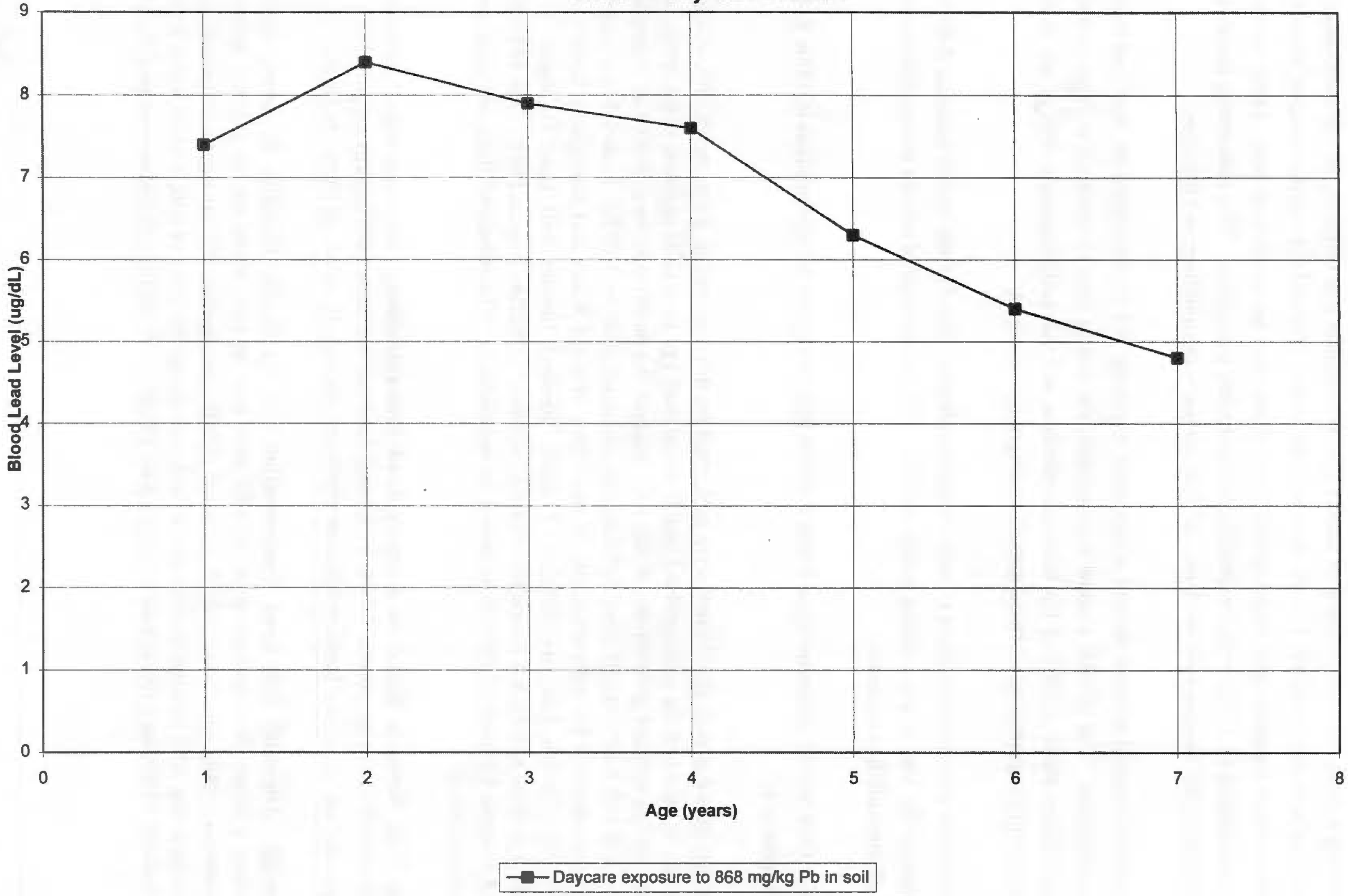
The IEUBK model parameter input values used for this assessment are summarized in Table K-1 in Appendix K.

Two day care exposure simulations were performed for this assessment. First, the IEUBK model was run to calculate the median blood lead levels at each age for a child exposed to the levels of lead found in soil and groundwater at this site. Second, the model was run to derive an example allowable soil lead concentration following the approach used by USEPA in deriving a target lead concentration for residential soil, in the Office of Solid Waste and Emergency Response (OSWER) Interim Directive #9355.4-12 titled "Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities" (USEPA, August 1994). The IEUBK model output for each simulation is shown in Appendix K. The results of these analyses are discussed below.

Day Care Scenario Based on Current Lead Concentrations. Day care center scenario ingestion of soil at the current SEAD 17 average lead concentration (868 mg/kg) is estimated to cause median blood lead levels in children which are less than 10 ug/dL, as shown in Figure 7-4.

Example Allowable Soil Lead Concentration. In the Interim Directive document, EPA derived a target lead concentration of 400 ppm lead in soil, based on its IEUBK model simulation. This simulation, which included default assumptions for all exposure pathways, estimated that with residential exposure to soil containing 400 ppm of soil, a child has a 95% probability of having a blood lead level less than 10 ug/dL. A similar calculation was performed

Figure 7-4
IEUBK Model Results
SEAD 17 Day Care Scenario



for this assessment based on the day care center soil ingestion scenario, as described above. For this day care center scenario, the IEUBK model predicts a 95% probability of having a blood lead level less than 10 ug/dL at a soil lead concentration of 625 ppm.

Figures 7-5 and 7-6 illustrate the IEUBK model results. Figure 7-5 is a plot of the cumulative probability distribution for exceeding 10 ug/dL lead in blood, associated with day care exposure to an average concentration of 625 ppm lead in soil. This plot shows that the probability of exceeding 10 ug/dL is 5%. Figure 7-6 shows the median blood lead levels at each age predicted for day care exposure to 625 ppm lead in soil. This figure also shows the IEUBK predictions for EPA's residential scenario target level of 400 ppm lead in soil. It can be seen that the results for the day care scenario and EPA's residential scenario are nearly identical. This result indicates that a target average concentration of 625 ppm lead in soil for day care exposure is consistent with EPA's residential target concentration and equally health-protective.

Adult Occupational Exposure

To qualitatively assess risks from adult occupational lead exposure, the site concentrations are compared with risk-based remediation goals (RBRGs) presented in "Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil" (USEPA, December 1996). In this report, EPA presents a model to calculate target soil concentrations of lead (RBRGs) at which the exposure for a women of child-bearing age would minimize risk to her fetus. Thus, while adult exposure is addressed by EPA's analysis, the most sensitive receptor (i.e., the fetus) is being protected.

EPA has calculated RBRGs for lead in soil using their recommended default parameters as inputs to the model. For a homogeneous, non-urban population exposed for 365 days per year, EPA suggests an RBRG of 1750 mg/kg lead in soil.

As shown in Table 7-3, the average concentrations for lead in surface soil, total soils and sediment range from 270 to 868 which are less than EPA's target value of 1,750 mg/kg discussed above. The outdoor air EPC is 0.013 ug/m^3 which is lower than the National Ambient Air Quality Standard for lead, which is 1.5 ug/m^3 (based on a 3-month average).

These results suggest that lead does not pose a health risk upon regular exposure to the site soils with the possible exception of children attending a day care center.

Figure 7-5
IEUBK Model Results
Example Allowable Soil Pb Concentration for Day Care Scenario
Cumulative Probability Plot of Blood Lead Concentration

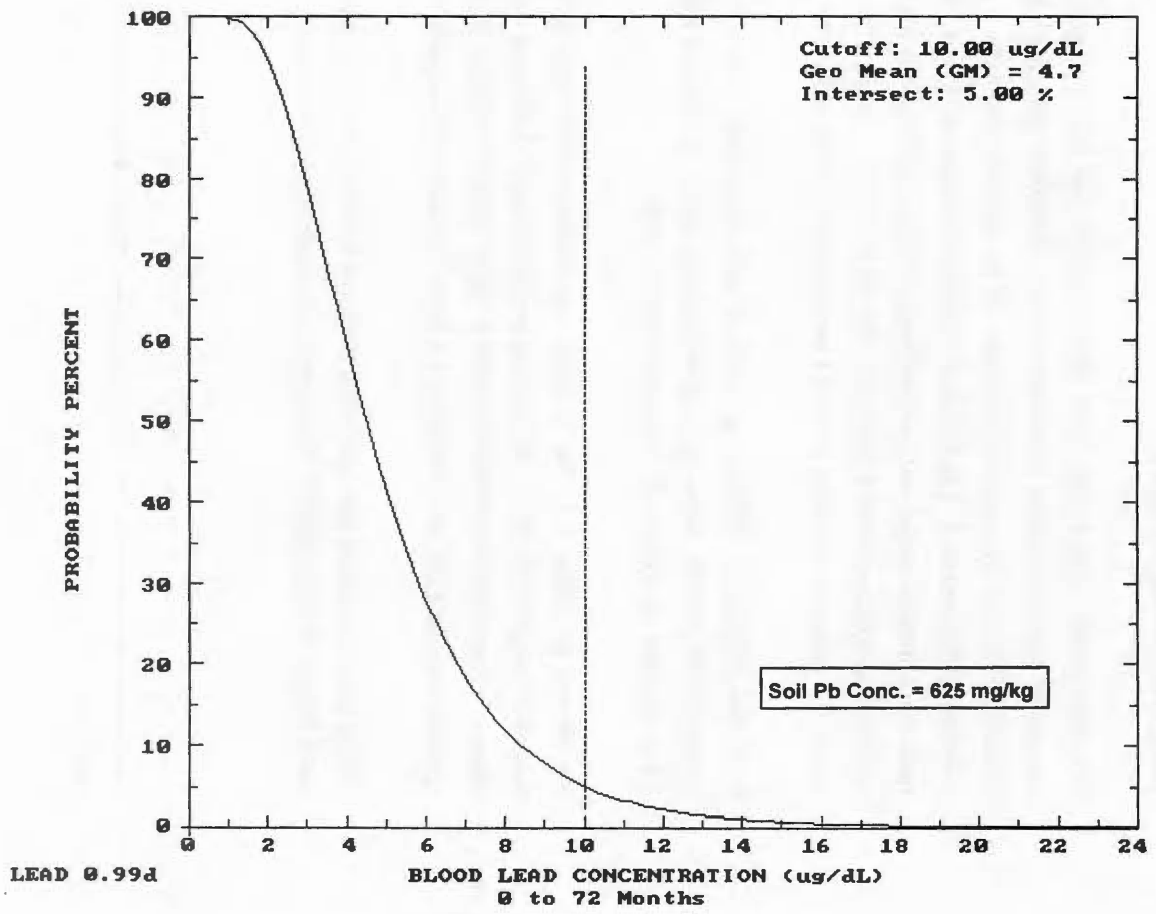
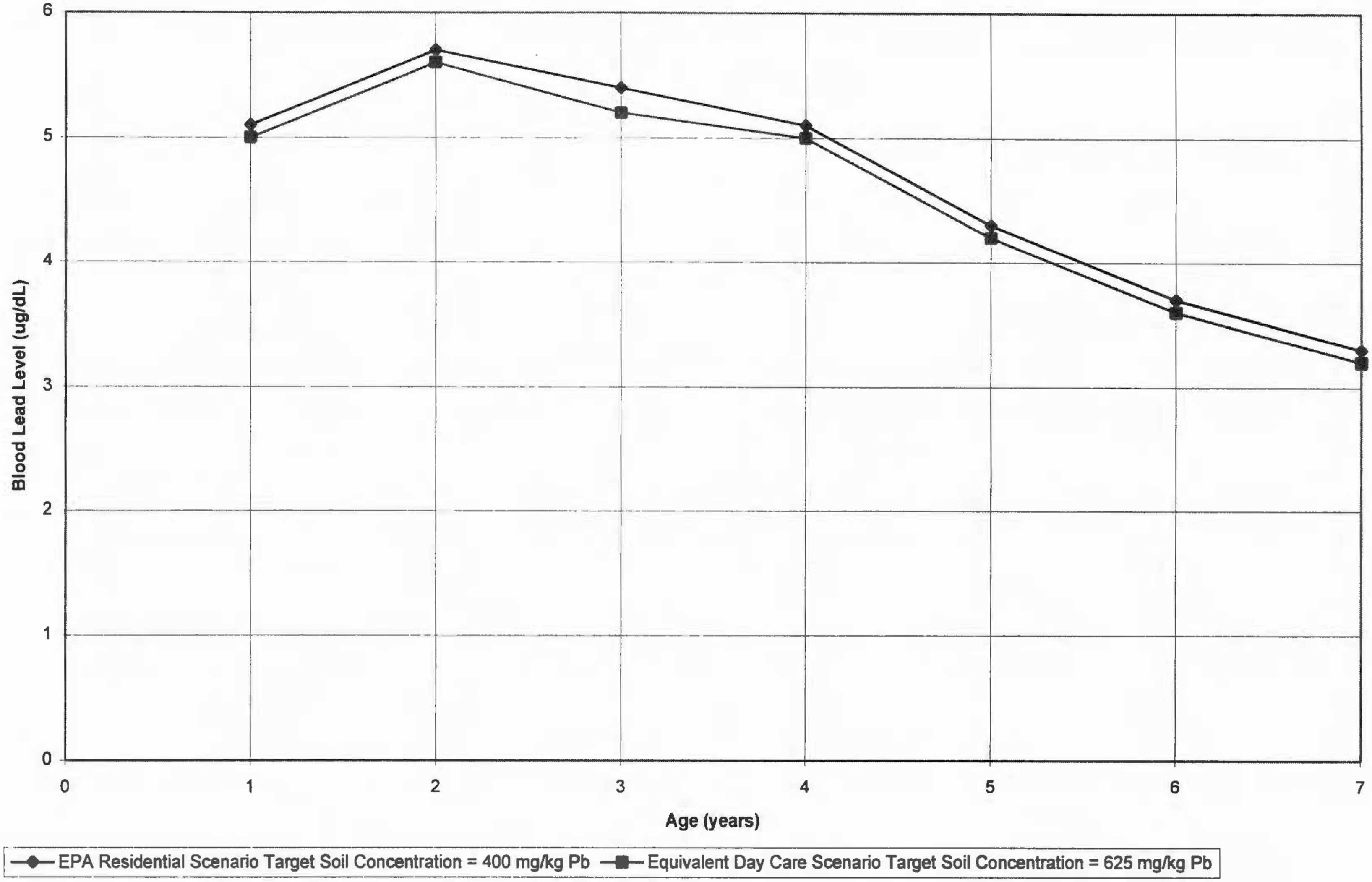


Figure 7-6

IEUBK Model Results

Comparison of Example Day Care Scenario with EPA Residential Scenario Target Soil Levels



h:\eng\seneca\risk\ieubk\lead.xls

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7.5.10 Uncertainty Assessment

All risk assessments involve the use of assumptions, judgments, and imperfect data to varying degrees. This results in uncertainty in the final estimates of risk. There are uncertainties associated with each component of the risk assessment from data collection through risk characterization. For example, there is uncertainty in the initial selection of substances used to characterize exposures and risk on the basis of the sampling data and available toxicity information. Other sources of uncertainty are inherent in the toxicity values for each substance and the exposure assessments used to characterize risk. Finally, additional uncertainties are incorporated into the risk assessment when exposures to several substances across multiple pathways are summed. Areas of uncertainty in each risk assessment step are discussed below.

7.5.10.1 Uncertainty in Data Collection and Evaluation

Uncertainties in the data collection/evaluation step of the risk assessment focus on determining whether enough samples were collected to adequately characterize the risk, and if sample analyses were conducted in a qualified manner to maximize the confidence in the results. Results of the sample analyses were used to develop a database which includes a complete list of the chemicals by media and their representative concentrations used in the risk assessment. The sampling and analysis was part of the comprehensive RI effort and addressed various objectives in addition to the risk assessment. Therefore, the samples were not collected randomly but were collected from areas of the site known to be contaminated. This type of non-random sampling biases the data collected toward overestimating chemical concentrations from the site. The judgmental bias in the sample collection also limits the applicability of statistics to the database. Because the statistics used to calculate the upper limit of the 95th-percentile confidence interval assume that the data represents a randomly distributed population, and the database does not, there is inherent uncertainty in the application of statistics. Collection of non-random, judgmental samples was necessary to adequately characterize the nature and extent of contamination which is an objective of the RI.

All chemicals detected that were potentially site-related were retained in this assessment. Chemicals that were never detected were eliminated from the assessment. This practice may slightly underestimate risks due to low levels (i.e., below the sample quantitation limit) of eliminated chemicals. Since samples were collected at areas where concentrations were expected to be high, it is very unlikely that any chemicals were present at the site at health-significant levels and not detected in at least one sample. However, if this did occur, this assumption will underestimate risk. The 95th UCLs were used to calculate site-related risks.

Since that assumption implies chronic exposure to the 95th UCL concentration, this assumption is likely to overestimate risk.

If a chemical was detected, it was retained in the risk assessment regardless of how frequently it was detected. To calculate the upper limit of the 95th-percentile confidence interval, chemicals were assumed to be present in all samples in a media. When the chemical was not detected in a sample, one-half of the SQL was used. Especially for chemicals that were detected in only a few samples, the upper limit of the 95th-percentile confidence interval probably greatly overestimates the amount of the chemical present and, consequently, the risk from the chemical.

RAGS guidance (USEPA, 1989a) states that if a small number of TICs are present relative to TCL compounds, they can be eliminated in the risk assessment. This process has the possibility of underestimating risk.

The database also includes a number of data validation flags, indicating uncertainty in the reliability of the performance of the analyses done by the laboratory. Flagged data were retained following RAGS guidance.

7.5.10.2 Uncertainty in Exposure Assessment

There are inherent uncertainties in predicting future land uses and future chemical concentrations. Future land use scenarios were based on current plans for redevelopment of this portion of SEDA. Current land uses were identified by characterizing the site's physical setting.

A large part of the risk assessment is the estimation of risks for a broad set of exposure scenarios and pathways. If exposure does not occur, no risks are present. This assessment does not factor in the probability of the exposure occurring. For certain pathways, exposure may be extremely unlikely. For example, the future Trespasser may not contact site soils, surface water and sediment at all, or with the frequency assumed. This assumption yields an overestimate of risk for this scenario.

Once pathways are identified, exposure point concentrations must be estimated. There is always some doubt as to how well an exposure model approximates the actual conditions receptors will be exposed to at a given site. Key assumptions in estimating exposure point concentrations and exposure assumptions and their potential impact on the assessment are described in the following paragraphs.

As summarized in Table 7-5, there are many factors which determine the level of exposure for each exposure pathway. These factors include inhalation rates, ingestion rates, exposure frequencies, exposure durations, body weight, etc. The values for these exposure factors must be selected by the risk assessor to represent each receptor. For the RME scenarios particularly, upper bound values were selected for each exposure factor. In the calculations of RME exposure, these multiple upper-bound exposure factor estimates compound to yield intakes and absorbed doses which overestimate likely exposure levels.

There is further uncertainty in the quantitative dermal exposure assessments for soil and sediment, since these assessments have been limited to just five compounds with credible dermal absorption factors. Many other compounds were measured in soil and sediment which might be absorbed through the skin, although reliable quantitative absorption factors are not available. Ignoring this larger group of chemicals results in quantitative exposure estimates (absorbed doses) which underestimate the true potential exposures from dermal contact. Consequently, any risk associated with these compounds is also underestimated.

There is also uncertainty associated with using oral toxicity values to calculate dermal risks. As seen in the literature, there are differences between oral and inhalation absorption efficiencies. These differences vary and will likely cause either underestimation or overestimation of dermal risks. The efficiencies are generally within 1 order of magnitude of each other, so the uncertainty introduced is less than 1 order of magnitude.

The EPCs derived from the measured chemical concentrations are assumed to persist without change for the entire duration of each exposure scenario. It is likely that some degradation would occur over time, particularly for some of the organic compounds, that would reduce the current concentrations. Therefore, this steady state assumption tends to overestimate exposure levels.

7.5.10.3 Uncertainty in Toxicity Assessment

Of the chemicals of potential concern, a number had no reference dose or slope factors. They are:

- acenaphthylene
- dibenzofuran
- phenanthrene
- benzo(g,h,i)perylene
- calcium
- cobalt

- lead
- magnesium
- potassium
- sodium
- Endrin Ketone
- delta-BHC
- 3-nitroaniline
- 4-nitroaniline

Several of these compounds have toxicity information such as weight of evidence classification indicating a strong potential for adverse health effects, particularly lead. The absence of toxicity values for these chemicals tends to underestimate risks.

For chromium, the valence state (e.g., III or VI) was not specifically determined. The toxicity assessment assumed all chromium to be in the Chromium VI valence state, which is the more toxic. This assumption most likely results in an overstatement of risk.

There is considerable uncertainty inherent in the toxicity values for both carcinogens and noncarcinogens. Many of the studies are based on animals and extrapolated to humans, and in some cases, subchronic studies must be used to assess chronic effects. Most cancer slope factors are calculated using a model which extrapolates low dose effects from high dose animal studies. Because toxicity constants are generally based on the upper limit of the 95th-percentile confidence interval or incorporate safety factors to compensate for uncertainty, chemical-specific risks may be overestimated.

Toxicity information was not available for dermal exposure; hence, several assumptions had to be made which may tend to over- or underestimate risk. Oral toxicity values were used without adjustment to calculate risks from dermal exposure because the USEPA has not derived toxicity values for this route of exposure. However, values found in the literature (Owen, 1990) indicate that the uncertainty associated with using oral absorption to estimate dermal absorption is likely less than one order of magnitude. This is due to the lack of scientific studies available to quantify dermal toxicity and carcinogenic potential for the vast majority of priority pollutants and because chemical specific information needed to convert ingested dose to absorbed dose is not available.

7.5.10.4 Uncertainty in Risk Characterization

Uncertainties in the toxicity assessment are compounded under the assumption of dose additivity for multiple substance exposure. That assumption ignores possible synergisms and antagonisms among chemicals, and assumes similarity in mechanisms of action and metabolism. Synergism is the amplification of one chemical's toxic effect by the presence of a second chemical. For example, it is known that smokers also exposed to asbestos have higher lung cancer incidence than either smokers or asbestos workers alone. Ignoring synergism to the extent that it may occur at environmental levels tends to underestimate risk. Antagonism is the reduction of one chemical's toxic effect by the presence of a second chemical. For example, certain foods (such as broccoli) contain chemicals believed to be anticarcinogenic. Ignoring antagonism tends to overestimate risk. Risks summed for chemicals having various weight-of-evidence classifications as well as different target organs may also tend to overestimate risk.

7.5.10.5 Central Tendency Risk

In addition to the RME risks detailed in previous sections, central tendency risks were calculated for the exposure scenarios. These results are summarized in Table 7-9. As described by EPA, the central tendency risk approximates the arithmetic mean or median risk, as opposed to the RME risk which describes exposures above the 90th percentile of the population distribution.

The central tendency risk is calculated by replacing some of the 95th percentile exposure parameters with 50th percentile or median values. For example, the 95th percentile value for employment at a single workplace, 25 years, is replaced by a more typical value of 7 years. Other values are replaced as described in the EPA guidance.

The central tendency risk, when compared to the RME risk helps to illustrate the uncertainty inherent in calculating only the RME risks. A comparison of Table 7-8 to 7-9 indicates that the central tendency HI's are approximately 30% to 50% of the RME HI's and the central tendency cancer risks are approximately 5% to 50% of the RME risks.

7.6 ECOLOGICAL RISK ASSESSMENT (ERA)

7.6.1 Objectives and Overview

In addition to the evaluation of human health, the BRA also must consider the risk posed by the site to the environment. The requirement for an evaluation of environmental risk to the ecological communities at this site is described in CERCLA, as amended by the Superfund Amendments and Reauthorization Act (SARA), in 40 CFR 300.430 (d),(4); and the New York Rules for Inactive Hazardous Waste Disposal Sites, Title 6, Chapter 4, Subchapter B, Part 375,

Subpart 375-1.4. Environmental risk is evaluated through the process of an Ecological Risk Assessment (ERA). Through this authority, the EPA and NYSDEC seek to protect wildlife, fisheries, endangered and threatened species, and critical habitats. These statutes also require that remedial actions selected for National Priorities List (NPL) sites be sufficient to protect both human health and the environment. This requires establishing the baseline of current site conditions that will be used as the basis of comparison in determining the degree that a remedial action will be protective of human health and the environment. This ERA is intended to establish this baseline of ecological site conditions and has been conducted and presented in parallel with the human health risk assessment in fulfillment of the requirements of CERCLA.
As preceding sections of this RI have indicated, a substantial site-specific database of chemical and physical information was developed to characterize the types, locations, and concentrations of chemicals in soil, sediment, surface water, and groundwater. Physical media samples were collected upgradient and downgradient from the site, and from on-site and off-site (for soils) background reference stations. Qualitative characterization of the ecological communities was performed to determine the ecological community at the site.

The ERA addresses potentially significant risks to the following biological groups and special-interest resources associated with the site: vascular vegetation, wildlife, aquatic life, endangered and threatened species, and wetlands. The focus of the ERA at SEAD-17 lies in the area of the Active Deactivation Furnace and the immediately surrounding vicinity. The Active Deactivation Furnace has been evaluated as a single site, with references being made to specific locations when it is appropriate. The aquatic study area included intermittent and perennial drainage ditches at the Active Deactivation Furnace. The terrestrial study area included the Active Deactivation Furnace and the area within a radius of approximately 2 miles from the site perimeter. Within the 2-mile radius, significant resources such as NYSDEC significant habitats; habitats supporting endangered, threatened, and rare species; species of concern; and state-regulated wetlands were identified. Within a smaller 0.5-mile radius of the site perimeter, the major vegetative communities, wildlife species associated with each cover type, and the value of the habitats to the associated wildlife were identified.

The purpose of the ERA component of the BRA is to evaluate the likelihood that adverse ecological effects are occurring or may occur as a result of exposure to chemicals associated with the site based on a weight-of-evidence approach. An ecological risk does not exist unless a given contaminant has the ability to cause one or more adverse effects and it either co-occurs with, or is contacted by, an ecological receptor for a sufficient length of time, or at a sufficient intensity to elicit the identified adverse effect(s) (EPA, 1994b).

The methodology used in this assessment was based on and complies with the intent of the *Procedural Guidelines for Ecological Risk Assessment at U.S. Army Sites, Volume 1* (Wentzel et al., 1994); the *Framework for Ecological Risk Assessment* (EPA, 1992); the *Risk Assessment Guidance for Superfund, Volume II, Environmental Evaluation Manual* (EPA, 1989); and the Division of Fish and Wildlife *Impact Analysis for Inactive Hazardous Waste Sites* (NYSDEC, 1994).

Unlike the human health risk assessment, ERAs are complicated by the fact that receptor species are initially unknown and must be identified. Further, data for the site-specific species present are generally not available from toxicological databases Recognizing the complexities associated with evaluating a diverse ecological community, guidance generally provides for a tiered approach to ERAs. The intent of the tiered approach is to collect sufficient information in order to formulate an opinion regarding the risk to the ecological communities present, within an acceptable degree of uncertainty. The tiered approach builds from Tier 1, the least complex, to Tier 3, the most complex, depending on the conditions of the site. The need to collect complex, site-specific toxicity data is reserved for sites where the Tier 1 field reconnaissance suggests that conditions warrant such data collection efforts. The purpose of the higher tiered approaches is to address data gaps and reduce the uncertainty in the risk characterization, thereby lessening the need for conservative assumptions.

Generally, a Tier 1 assessment involves performing a field survey to gain an understanding of the community to be evaluated and collecting quantitative site-specific data to characterize the chemicals of potential concern (COPCs) at the site. The ERA Tier 1 assessment is also supplemented with a literature study. Ecological receptors are determined following the integration of this information. Impacts from exposure are determined using conservative assumptions to assure that a reasonable degree of protection is maintained. Ecological risk is then presented in terms of a hazard quotient (HQ), which is defined as the ratio of the expected exposure point concentration to an appropriate toxicity reference value (TRV). Separate HQs are calculated for each contaminant/receptor pair and are summed, if appropriate, to derive a sitewide hazard index (HI). Uncertainties for the Tier 1 approach are the greatest and arise from extrapolation of the available toxicity data and inference regarding exposure. In general, ratios of exposure point concentration to TRV greater than 1 are considered to indicate a potential risk. Due to the uncertainties associated with using this approach, safety factors are considered in interpreting the findings. HQs between 1 and 10 are interpreted as having some potential for adverse effects; whereas, HQs between 10 and 100 indicate a significant potential for adverse effects. HQs greater than 100 indicate that adverse effects can be expected.

Tier 2 assessments address site-specific issues, limiting reliance on literature-cited values. This may include laboratory studies or limited field studies to determine site-specific TRVs. Tier 3 assessments involve the most complex effort, combining site-specific field observations with laboratory and field data to refine the assumptions of ecological exposure and ecological effects characterization. Tier 3 studies contain population and ecosystem-level evaluations that include long-term characterizations.

The SEAD-17 ERA used a Tier 1 approach and it addresses the three major ERA components: problem formulation, analysis, and risk characterization.

Initial screening of chemicals detected in site samples and selection of COPCs is discussed in Section 7.6.2.1. Characterization of the site and the ecological communities, including the ecological conditions observed at the site, is described in Section 7.6.2.2. Section 7.6.2.3 presents selection of assessment endpoints, receptors, and a conceptual site model. The analysis plan, including measures of effect, measures of exposures, and measures of ecosystem and receptor characteristics is presented in Section 7.6.2.4.

Exposure assessment topics are discussed in Section 7.6.3. Section 7.6.3.1 discusses the chemical distribution of the COPCs at the site. Receptor distribution and its effects on exposure are discussed in Section 7.6.3.2. Daily intakes of COPCs through exposure to environmental media are quantified in Section 7.6.3.3. The assessment of ecological effects that potentially may result from receptor exposure to COPCs at the site is discussed in Section 7.6.3.4, Effects Assessment. This section includes the evaluation of the potential toxicity of each COPC in each medium and defines toxicity reference values that will be used to calculate the HQ.

Section 7.6.4, Risk Characterization, integrates the results of the preceding elements of the assessment. It estimates risk with respect to the assessment endpoints, based on the predicted exposure to and toxicity of each COPC. The risk characterization also summarizes the ecological risk and interprets its ecological significance, and identifies those chemicals that should be considered chemicals of concern (COCs) for each medium at the site.

7.6.2 **Problem Formulation**

Problem formulation establishes the goals, breadth, and focus of the ERA through the following:

- Identification of the ecological COPCs
- Characterization of ecological communities
- Selection of assessment endpoints

- Presentation of an ecological conceptual site model
- Selection of an analysis plan (including measures of effects).

7.6.2.1 Identification of Ecological Constituents of Potential Concern

As described in Section 7.2, environmental media were sampled at the Active Deactivation Furnace during the RI to characterize the nature and the extent of impacts in each medium. Following data validation, the data were uploaded into medium-specific databases and each database was then simplified to remove from further consideration those constituents that were either not detected during the investigations or were determined to be similar to background concentrations (for inorganics only). The analytes detected in soil, surface water, sediment, and groundwater are listed in Table 7-3, along with their frequency of detection and maximum detected concentration. The data were evaluated in accordance with EPA data validation guidance contained in *Risk Assessment Guidance for Superfund: Volume I - Human Health Evaluation Manual* (EPA, 1989). All data qualifiers were considered.

After combining analytical data and eliminating those analytes not detected in any samples in a particular medium, the analytical data were evaluated on the basis of quality with respect to sample quantitation limits, laboratory qualifiers and codes, and blanks. Data were selected for use in the BRA based on EPA guidance (EPA, 1989) and included data with no qualifiers, data with qualifiers that indicated uncertainties in concentrations but not in chemical identification, and data for chemical concentrations detected at levels significantly elevated above concentrations detected in associated sample blanks. Contaminant data that were rejected for use in the risk assessment were those with an R (unreliable) qualifier.

Following the elimination of unreliable data, concentrations in soil were compared to appropriate background levels, as described in Section 7.2.3 and presented in Table 7-2. Inorganic analytes in soil and groundwater were eliminated from the site risk assessment if the statistical evaluation of significance, using the Wilcoxsin Ranked Sum (WRS) Test determined that there was no significant difference at the 95th percentile confidence interval, between the site data set and the background database. The background database used for comparison comprises over 60 soil samples and 31 groundwater samples, collected at numerous sites throughout the 10,000-acre SEDA facility, and is representative of background soil and groundwater concentrations. Facility-wide background data were used to identify elevated concentrations of inorganic analytes related to the site. No comparison to background for anthropogenic organic compounds, such as polynuclear aromatic hydrocarbons (PAHs), was performed as the concentrations of these compounds are generally below detectable concentrations in the background locations used to construct the existing database. The existing background soil database has been compiled over the past five years of investigations and the background groundwater database over the past three years of investigations, each from several locations within the SEDA facility boundary. These databases represent soil and groundwater concentrations at locations considered to be pristine. Consequently, no organic compounds were eliminated from further consideration as a result of this comparison.

The draft *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (EPA, 1994b) describes an initial screening step in an ERA.

This step consists of preliminary problem formulation, for which the following are determined:

- Environmental setting and constituents at the site
- Fate and transport of constituents
- Ecotoxicity and potential receptors
- Complete exposure pathways.

According to EPA guidance (EPA, 1994b), the next step in the screening process is the evaluation of the ecological effects associated with the chemicals at the site and development of a toxicity profile and screening ecotoxicity value for those chemicals. The toxicity profile, gathered from information in the scientific literature, should describe the toxic mechanisms of action for the exposure route being evaluated and the dose that causes a specified adverse effect. A screening-level ecotoxicity value, or benchmark, should be developed. The highest exposure level at which no adverse effects have been demonstrated is appropriate for the initial screening assessment to ensure that risk is not underestimated. Consistent with the EPA guidance, for each receptor and constituent, the maximum detected concentration is compared to the appropriate screening value, which includes the following:

a. Soil screening using no observed adverse effect levels (NOAELs) for wildlife species (based on dietary exposure)

   The maximum concentration of each analyte detected in each soil exposure group (surface and subsurface soil) was incorporated into a dietary intake equation and was then compared to a risk-based dietary benchmark. The screening intake equation, based on *EPA Region IV Guidance for Wildlife Screening Values* (EPA, 1995), conservatively assumes that the entire diet of the receptor consists of soil, all of which contains the maximum detected concentration of the analyte. Receptors are not site-specific, but instead, are the animals used in the analyte-specific toxicity studies, as shown in Table 7-

10. However, since a deer mouse was selected as a site-specific receptor for the later phases of the risk assessment, toxicity tests using species most closely related to the deer mouse were sought.

The screening intake equation is:

$$SI = (Cs_{max}) (f) (l/w)$$

where:

SI = screening intake in milligrams per kilogram body weight per day (mg/kg/d)
Cs_{max} = maximum soil concentration in mg/kg
f = feeding rate of test animal in kg/d dry weight ingested
w = body weight of test animal in kg

Maximum concentrations of the surface soil analytes (0 to 0.5 ft) are shown in Table 7-11, and for the subsurface soil (0 to 4 ft) in Table 7-12. Toxicity benchmarks reflecting a dietary NOAEL were sought for benchmarks in the soil screening. Where NOAEL tests could not be found, other tests with endpoints of lowest observed adverse effect level (LOAEL) or lethal dose for 50 percent of the test animals (LD_{50}) were used, with appropriate uncertainty factors to equate the test to a NOAEL. Uncertainty factors were

TABLE 7-10

TOXICITY DATA FOR ECOLOGICAL SCREENING
SURFACE AND SUBSURFACE SOIL

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Constituent	Test Organism	Endpoint/Duration/Effect	Source	Effect Dose (mg/kg/d)	Surrogate Chemical UF[1]	Endpoint UF[1]	Study Duration UF[1]	Total UF[1]	Toxicity Screening Benchmark (mg/kg/d)[2]
Volatile Organics									
Acetone	mouse	NOAEL, water, 13-wk, reproductive effects	ATSDR 1994a	4.86E+03	1	1	5	5	9.72E+02
Benzene	mouse	LOAEL, water, 4-wk, immunologic/neurologic effects	ATSDR 1995a	8.00E+00	1	5	10	50	1.60E-01
Methylene chloride	mouse	NOAEL, water, 104-wk, hepatic effects	ATSDR 1991c	1.75E+02	1	1	1	1	1.75E+02
Toluene	mouse	NOAEL, water, 28-day, liver weight	ATSDR 1994h	2.20E+01	1	1	10	10	2.20E+00
Semivolatile Organics									
2,4-Dinitrotoluene	rat	NOAEL, diet, 2-yr, changes in seminiferous tubules	EPA (IRIS) 1996b	3.90E+00	1	1	1	1	3.90E+00
2,6-Dinitrotoluene	rat	Used 2,4-dinitrotoluene as surrogate		3.90E+00	10	1	1	10	3.90E-01
2-Methylnaphthalene	mouse	Used napthalene as surrogate		1.33E+02	10	1	5	50	2.66E+00
2-Methylphenol	mink	NOAEL, diet, 6 months, reproduction	Sample et al 1996	2.19E+02	1	1	5	5	4.38E+01
3,3-Dichlorobenzidene	mouse	LD50, oral, female	EPA (STF) 1996d	3.52E+02	1	15	10	150	2.35E+00
3-Nitroaniline	mouse	Used 4-nitroaniline as surrogate		8.10E+02	10	15	10	1500	5.40E-01
4-Nitroaniline	mouse	LD50, oral	EPA (STF) 1996d	8.10E+02	1	15	10	150	5.40E+00
Acenaphthene	mouse	LOAEL, gavage (oil), 13-wk, hepatic effects	ATSDR 1995c	1.75E+02	1	5	5	25	7.00E+00
Acenaphthylene	mouse	Used benzo(a)pyrene as surrogate		1.60E+02	10	5	1	50	3.20E+00
Anthracene	mouse	NOAEL, gavage (oil), 13-wk, repro, hepatic effects	ATSDR 1995c	1.00E+03	1	1	5	5	2.00E+02
Benzo(a)anthracene	mouse	Used benzo(a)pyrene as surrogate		1.60E+02	10	5	1	50	3.20E+00
Benzo(a)pyrene	mouse	LOAEL, gavage, gestation day 7-16, repro effects	ATSDR 1995c	1.60E+02	1	5	1	5	3.20E+01
Benzo(b)fluoranthene	mouse	Used benzo(a)pyrene as surrogate		1.60E+02	10	5	1	50	3.20E+00
Benzo(ghi)perylene	mouse	Used benzo(a)pyrene as surrogate		1.60E+02	10	5	1	50	3.20E+00
Benzo(k)fluoranthene	mouse	Used benzo(a)pyrene as surrogate		1.60E+02	10	5	1	50	3.20E+00
Butylbenzyl phthalate	rat	NOAEL, diet, 6-mo, liver pathology	EPA (IRIS) 1996b	1.59E+02	1	1	5	5	3.18E+01
Carbazole	rat	LDLo, diet	RTECS 1996	4.25E+01	1	10	10	100	4.25E-01
Chrysene	mouse	Used benzo(a)pyrene as surrogate		1.60E+02	10	5	1	50	3.20E+00
Di-n-butyl phthalate	mouse	NOAEL, diet, 105-day, repro, hepatic, body wt effects	ATSDR 1989	3.90E+02	1	1	5	5	7.80E+01
Dibenz(a,h)anthracene	mouse	Used benzo(a)pyrene as surrogate		1.60E+02	10	5	1	50	3.20E+00
Dibenzofuran		no data							no data
Fluoranthene	mouse	LOAEL, gavage (oil), 13-wk, incr liver weight	ATSDR 1995c	1.25E+02	1	5	5	25	5.00E+00
Flourene	mouse	LOAEL, gavage (oil), 13-wk, incr liver weight	ATSDR 1995c	1.25E+02	1	5	5	25	5.00E+00
Indeno(1,2,3-cd)pyrene	mouse	Used benzo(a)pyrene as surrogate		1.60E+02	10	5	1	50	3.20E+00
N-nitrosodiphenylamine	mouse	LOAEL, diet, 98-wk, bladder effects	ATSDR 1991d	3.01E+02	1	5	1	5	6.02E+01
Naphthalene	mouse	NOAEL, gavage (oil), 90-day, multiple systems	ATSDR 1995d	1.33E+02	1	1	5	5	2.66E+01
Pentachlorophenol	rat	NOAEL, diet, 62-d prior to mating, 15-d during mating,	Sample et al 1996	2.40E-01	1	1	1	1	2.40E-01
Phenanthrene	mouse	Used benzo(a)pyrene as surrogate		1.60E+02	10	5	1	50	3.20E+00
Pyrene	mouse	Used benzo(a)pyrene as surrogate		1.60E+02	10	5	1	50	3.20E+00
bis(2-Chloroisopropyl) ether	mouse	NOAEL, diet, 104-wk, hematological effects	EPA (IRIS) 1996b	3.58E+01	1	1	1	1	3.58E+01
bis(2-Ethylhexyl)phthalate	rat	LOAEL, diet, 2-year, hepatic cell membrane structure	ATSDR 1993a	1.00E+01	1	5	1	5	2.00E+00

TABLE 7-10

TOXICITY DATA FOR ECOLOGICAL SCREENING
SURFACE AND SUBSURFACE SOIL

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Constituent	Test Organism	Endpoint/Duration/Effect	Source	Effect Dose (mg/kg/d)	Surrogate Chemical UF[1]	Endpoint UF[1]	Study Duration UF[1]	Total UF[1]	Toxicity Screening Benchmark (mg/kg/d)[2]
Pesticides/PCBs									
4,4-DDD	mouse	NOAEL, diet, 78-wk, multiple systems	ATSDR 1994d	1.07E+02	1	1	1	1	1.07E+02
4,4-DDE	mouse	NOAEL, diet, 78-week, multiple systems	ATSDR 1994d	3.40E+01	1	1	1	1	3.40E+01
4,4-DDT	mouse	LOAEL, diet, 70-week, decreased survival, tremors	ATSDR 1994d	1.30E+01	1	5	1	5	2.60E+00
Aldrin	rat	NOAEL, diet, 3 generations (>1yr), repro effects	Sample et al 1996	2.00E-01	1	1	1	1	2.00E-01
Arochlor-1254	oldfield	LOAEL, diet, 12 months, repro effects	Sample et al 1996	6.80E-01	1	5	1	5	1.36E-01
Arochlor-1260		Used Arochlor-1254 as surrogate		6.80E-01	10	5	1	50	1.36E-02
Dieldrin	rat	LOAEL, diet, 3 generations (> 1 yr), repro effects	Sample et al 1996	2.00E-01	1	5	1	5	4.00E-02
Endosulfan I	mouse	NOAEL, diet, 78-week, renal effects	ATSDR 1993b	2.50E+00	1	1	1	1	2.50E+00
Endosulfan sulfate	mouse	Used endosulfan as surrogate		2.50E+00	10	1	1	10	2.50E-01
Endrin	mouse	LOAEL, diet, 80-week, multiple systems	ATSDR 1994e	4.20E-01	1	5	1	5	8.40E-02
Endrin ketone	mouse	Used endrin as surrogate		4.20E-01	10	5	1	50	8.40E-03
Heptachlor epoxide	rat	Used heptachlor as surrogate	ATSDR 1993c	6.00E+00	10	5	1	50	1.20E-01
alpha Chlordane	mouse	NOAEL, diet, 24-mo, hepatic effects	ATSDR 1994c	1.00E-01	1	1	1	1	1.00E-01
beta-BHC	rat	NOAEL, diet, 13-week, growth, blood chem, histology	Sample et al 1996	4.00E+00	1	1	5	5	8.00E-01
delta-BHC	rat	NOAEL, diet, 4 generations, repro effects	Sample et al 1996	1.60E+00	1	1	1	1	1.60E+00
Herbicides									
MCPA	rat	LEL, diet, 90-day, increased kidney weight	EPA (IRIS) 1996b	7.60E+00	1	5	5	25	3.04E-01
Metals									
Antimony	mouse	NOAEL, water, 542-day, hepatic effects	ATSDR 1990a	3.50E-01	1	1	1	1	3.50E-01
Arsenic	mouse	LOAEL, gavage, 19-day, reduced fertility	ATSDR 1991a	5.50E+01	1	5	10	50	1.10E+00
Barium	rat	NOAEL, drinking water, 16-mo	Sample et al 1996	5.06E+00	1	1	1	1	5.06E+00
Cadmium	mouse	LOAEL, 12-mo, hematological effects	ATSDR 1991b	5.70E+01	1	5	1	5	1.14E+01
Copper	mouse	NOAEL, diet, 13-wk, gastrointestinal effects	ATSDR 1990d	7.10E+01	1	1	5	5	1.42E+01
Lead	rat	NOAEL, food, 3 generations, reproduction	Sample et al 1996	8.00E+00	1	1	1	1	8.00E+00
Mercury	mouse	NOAEL, diet, 104-week, kidney effects	ATSDR 1994f	3.00E-02	1	1	1	1	3.00E-02
Selenium	mouse	LOAEL, water, 3 generations, reproductive effects	Sample et al 1996	7.50E-01	1	5	1	5	1.50E-01
Silver	mouse	LOAEL, water, 125-day, decr in activity	ATSDR 1990e	1.81E+01	1	5	5	25	7.24E-01
Thallium	rat	NOAEL, gavage, 90-day, multiple systems	ATSDR 1990f	2.00E-01	1	1	5	5	4.00E-02
Zinc	rat	NOAEL, diet, gestation day 1-16, development effect	Sample et al 1996	1.60E+02	1	1	1	1	1.60E+02

[1] UF = uncertainty factor. Uncertainty factors are based on a modified EPA Region VIII method as discussed in Section 6.6.

[2] The toxicity screening benchmark was derived by dividing the effect dose by the total uncertainty factor.

TABLE 7-11

SOIL SCREENING AGAINST ECOLOGICAL TOXICITY SCREENING BENCHMARKS
SURFACE SOIL

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Constituent	Maximum Detected Conc. (mg/kg)	Test Organism	Feeding Rate [1] (kg/d)	Body Weight [1] (kg)	Soil Screening Intake [2] (mg/kg/d)	Toxicity Screening Benchmark[3] (mg/kg/d)	Intake Exceeds Toxicity Screening Benchmark[4] (Y/N)
Volatile Organics							
Acetone	1.50E-02	mouse	3.31E-03	2.50E-02	1.99E-03	9.72E+02	N
Benzene	2.00E-03	mouse	3.31E-03	2.50E-02	2.65E-04	1.60E-01	N
Methylene chloride	4.00E-03	mouse	3.31E-03	2.50E-02	5.30E-04	1.75E+02	N
Toluene	5.00E-03	mouse	3.31E-03	2.50E-02	6.62E-04	2.20E+00	N
Semivolatile Organics							
2,4-Dinitrotoluene	1.40E+00	rat	2.55E-02	3.00E-01	1.19E-01	3.90E+00	N
2,6-Dinitrotoluene	9.00E-01	rat	2.55E-02	3.00E-01	7.65E-02	3.90E-01	N
2-Methylnaphthalene	1.30E-01	mouse	3.31E-03	2.50E-02	1.72E-02	2.66E+00	N
2-Methylphenol	1.20E-01	mink	1.37E-01	1.00E+00	1.64E-02	4.38E+01	N
3,3'-Dichlorobenzidine	4.10E-01	mouse	3.31E-03	2.50E-02	5.43E-02	2.35E+00	N
3-Nitroaniline	9.90E-01	mouse	3.31E-03	2.50E-02	1.31E-01	5.40E-01	N
4-Nitroaniline	9.90E-01	mouse	3.31E-03	2.50E-02	1.31E-01	5.40E+00	N
Acenaphthene	3.30E-02	mouse	3.31E-03	2.50E-02	4.37E-03	7.00E+00	N
Acenaphthylene	9.60E-02	mouse	3.31E-03	2.50E-02	1.27E-02	3.20E+00	N
Anthracene	1.30E-01	mouse	3.31E-03	2.50E-02	1.72E-02	2.00E+02	N
Benzo(a)anthracene	7.20E-01	mouse	3.31E-03	2.50E-02	9.53E-02	3.20E+00	N
Benzo(a)pyrene	9.40E-01	mouse	3.31E-03	2.50E-02	1.24E-01	3.20E+01	N
Benzo(b)fluoranthene	2.20E+00	mouse	3.31E-03	2.50E-02	2.91E-01	3.20E+00	N
Benzo(g,h,i)perylene	7.10E-01	mouse	3.31E-03	2.50E-02	9.40E-02	3.20E+00	N
Benzo(k)fluoranthene	5.30E-01	mouse	3.31E-03	2.50E-02	7.02E-02	3.20E+00	N
Butylbenzylphthalate	4.60E-02	rat	2.55E-02	3.00E-01	3.91E-03	3.18E+01	N
Carbazole	4.10E-01	rat	2.55E-02	3.00E-01	3.49E-02	4.25E-01	N
Chrysene	6.70E-01	mouse	3.31E-03	2.50E-02	8.87E-02	3.20E+00	N
Di-n-butylphthalate	1.20E+00	mouse	3.31E-03	2.50E-02	1.59E-01	7.80E+01	N
Dibenz(a,h)anthracene	4.70E-01	mouse	3.31E-03	2.50E-02	6.22E-02	3.20E+00	N
Dibenzofuran	3.60E-02					no data	**Y**
Fluoranthene	1.00E+00	mouse	3.31E-03	2.50E-02	1.32E-01	5.00E+00	N

TABLE 7-11

SOIL SCREENING AGAINST ECOLOGICAL TOXICITY SCREENING BENCHMARKS SURFACE SOIL

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Constituent	Maximum Detected Conc. (mg/kg)	Test Organism	Feeding Rate [1] (kg/d)	Body Weight [1] (kg)	Soil Screening Intake [2] (mg/kg/d)	Toxicity Screening Benchmark [3] (mg/kg/d)	Intake Exceeds Toxicity Screening Benchmark [4] (Y/N)
Fluorene	3.80E-02	mouse	3.31E-03	2.50E-02	5.03E-03	5.00E+00	N
Indeno(1,2,3-cd)pyrene	7.90E-01	mouse	3.31E-03	2.50E-02	1.05E-01	3.20E+00	N
n-Nitrosodiphenylamine	9.50E-02	mouse	3.31E-03	2.50E-02	1.26E-02	6.02E+01	N
Naphthalene	3.70E-02	mouse	3.31E-03	2.50E-02	4.90E-03	2.66E+01	N
Pentachlorophenol	9.90E-01	rat	2.55E-02	3.00E-01	8.42E-02	2.40E-01	N
Phenanthrene	3.60E-01	mouse	3.31E-03	2.50E-02	4.77E-02	3.20E+00	N
Pyrene	1.20E+00	mouse	3.31E-03	2.50E-02	1.59E-01	3.20E+00	N
bis(2-Chloroisopropyl) ether	4.10E-01	mouse	3.31E-03	2.50E-02	5.43E-02	3.58E+01	N
bis(2-Ethylhexyl)phthalate	1.30E+00	rat	2.55E-02	3.00E-01	1.11E-01	2.00E+00	N
Pesticides							
4,4'-DDD	1.50E-02	mouse	3.31E-03	2.50E-02	1.99E-03	1.07E+02	N
4,4'-DDE	1.40E-01	mouse	3.31E-03	2.50E-02	1.85E-02	3.40E+01	N
4,4'-DDT	1.60E-02	mouse	3.31E-03	2.50E-02	2.12E-03	2.60E+00	N
Aldrin	1.90E-03	rat	2.55E-02	3.00E-01	1.62E-04	2.00E-01	N
Aroclor-1260	2.80E-02	oldfield mouse	1.74E-03	1.20E-02	4.06E-03	1.36E-02	N
Dieldrin	8.00E-02	rat	2.55E-02	3.00E-01	6.80E-03	4.00E-02	N
Endosulfan I	4.30E-01	mouse	3.31E-03	2.50E-02	5.69E-02	2.50E+00	N
Endosulfan sulfate	2.00E-02	mouse	3.31E-03	2.50E-02	2.65E-03	2.50E-01	N
Endrin	4.30E-02	mouse	3.31E-03	2.50E-02	5.69E-03	8.40E-02	N
Endrin ketone	7.10E-02	mouse	3.31E-03	2.50E-02	9.40E-03	8.40E-03	Y
Heptachlor epoxide	1.10E-03	rat	2.55E-02	3.00E-01	9.35E-05	1.20E-01	N
alpha-Chlordane	1.10E-03	mouse	3.31E-03	2.50E-02	1.46E-04	1.00E-01	N
beta-BHC	2.00E-02	rat	2.55E-02	3.00E-01	1.70E-03	8.00E-01	N
delta-BHC	2.20E-03	rat	2.55E-02	3.00E-01	1.87E-04	1.60E+00	N
Herbicides							
MCPA	3.40E+01	rat	2.55E-02	3.00E-01	2.89E+00	3.04E-01	Y

TABLE 7-11

SOIL SCREENING AGAINST ECOLOGICAL TOXICITY SCREENING BENCHMARKS
SURFACE SOIL

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Constituent	Maximum Detected Conc. (mg/kg)	Test Organism	Feeding Rate [1] (kg/d)	Body Weight [1] (kg)	Soil Screening Intake [2] (mg/kg/d)	Toxicity Screening Benchmark [3] (mg/kg/d)	Intake Exceeds Toxicity Screening Benchmark [4] (Y/N)
Metals							
Arsenic	1.61E+01	mouse	3.31E-03	2.50E-02	2.13E+00	1.10E+00	Y
Barium	5.24E+02	rat	2.55E-02	3.00E-01	4.45E+01	5.06E+00	Y
Cadmium	2.55E+01	mouse	3.31E-03	2.50E-02	3.38E+00	1.14E+01	N
Copper	8.37E+02	mouse	3.31E-03	2.50E-02	1.11E+02	1.42E+01	Y
Lead	6.34E+03	rat	2.55E-02	3.00E-01	5.39E+02	8.00E+00	Y
Mercury	1.00E+00	mouse	3.31E-03	2.50E-02	1.32E-01	3.00E-02	Y
Selenium	1.70E+00	mouse	3.31E-03	2.50E-02	2.25E-01	1.50E-01	Y
Silver	9.00E+00	mouse	3.31E-03	2.50E-02	1.19E+00	7.24E-01	Y
Thallium	1.50E+00	rat	2.55E-02	3.00E-01	1.28E-01	4.00E-02	Y
Zinc	1.53E+03	rat	2.55E-02	3.00E-01	1.30E+02	1.60E+02	N

[1] Body weight and feeding rate are based on the species used in the toxicity study from which the toxicity screening benchmark for this chemical was derived (see Table 7-10).

[2] Soil screening intake = (maximum concentration * feeding rate) / body weight.

[3] Toxicity screening benchmarks are calculated from toxicity values with appropriate EPA Region VIII uncertainty factors to derive a NOAEL equivalent value (see Table 7-10).

[4] Y = Soil screening intake exceeds toxicity screening benchmark, or no screening benchmark is available.
N = Soil screening intake is less than toxicity screening benchmark.

TABLE 7-12

SOIL SCREENING AGAINST ECOLOGICAL TOXICITY SCREENING BENCHMARKS
SUBSURFACE SOIL

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Constituent	Maximum Detected Conc. (mg/kg)	Test Organism	Feeding Rate [1] (kg/d)	Body Weight [1] (kg)	Soil Screening Intake [2] (mg/kg/d)	Toxicity Screening Benchmark[3] (mg/kg/d)	Intake Exceeds Toxicity Screening Benchmark[4] (Y/N)
Volatile Organics							
Acetone	1.50E-02	mouse	3.31E-03	2.50E-02	1.99E-03	9.72E+02	N
Benzene	2.00E-03	mouse	3.31E-03	2.50E-02	2.65E-04	1.60E-01	N
Methylene chloride	4.00E-03	mouse	3.31E-03	2.50E-02	5.30E-04	1.75E+02	N
Toluene	5.00E-03	mouse	3.31E-03	2.50E-02	6.62E-04	2.20E+00	N
Semivolatile Organics							
2,4-Dinitrotoluene	1.40E+00	rat	2.55E-02	3.00E-01	1.19E-01	3.90E+00	N
2,6-Dinitrotoluene	9.00E-01	rat	2.55E-02	3.00E-01	7.65E-02	3.90E-01	N
2-Methylnaphthalene	1.30E-01	mouse	3.31E-03	2.50E-02	1.72E-02	2.66E+00	N
2-Methylphenol	1.20E-01	mink	1.37E-01	1.00E+00	1.64E-02	4.38E+01	N
3,3'-Dichlorobenzidine	4.10E-01	mouse	3.31E-03	2.50E-02	5.43E-02	2.35E+00	N
3-Nitroaniline	9.90E-01	mouse	3.31E-03	2.50E-02	1.31E-01	5.40E-01	N
4-Nitroaniline	9.90E-01	mouse	3.31E-03	2.50E-02	1.31E-01	5.40E+00	N
Acenaphthene	3.30E-02	mouse	3.31E-03	2.50E-02	4.37E-03	7.00E+00	N
Acenaphthylene	9.60E-02	mouse	3.31E-03	2.50E-02	1.27E-02	3.20E+00	N
Anthracene	1.30E-01	mouse	3.31E-03	2.50E-02	1.72E-02	2.00E+02	N
Benzo(a)anthracene	7.20E-01	mouse	3.31E-03	2.50E-02	9.53E-02	3.20E+00	N
Benzo(a)pyrene	9.40E-01	mouse	3.31E-03	2.50E-02	1.24E-01	3.20E+01	N
Benzo(b)fluoranthene	2.20E+00	mouse	3.31E-03	2.50E-02	2.91E-01	3.20E+00	N
Benzo(g,h,i)perylene	7.10E-01	mouse	3.31E-03	2.50E-02	9.40E-02	3.20E+00	N
Benzo(k)fluoranthene	5.30E-01	mouse	3.31E-03	2.50E-02	7.02E-02	3.20E+00	N
Butylbenzylphthalate	4.60E-02	rat	2.55E-02	3.00E-01	3.91E-03	3.18E+01	N
Carbazole	4.10E-01	rat	2.55E-02	3.00E-01	3.49E-02	4.25E-01	N
Chrysene	6.70E-01	mouse	3.31E-03	2.50E-02	8.87E-02	3.20E+00	N
Di-n-butylphthalate	1.20E+00	mouse	3.31E-03	2.50E-02	1.59E-01	7.80E+01	N
Dibenz(a,h)anthracene	4.70E-01	mouse	3.31E-03	2.50E-02	6.22E-02	3.20E+00	N
Dibenzofuran	3.60E-02					no data	Y
Fluoranthene	1.00E+00	mouse	3.31E-03	2.50E-02	1.32E-01	5.00E+00	N
Fluorene	3.80E-02	mouse	3.31E-03	2.50E-02	5.03E-03	5.00E+00	N
Indeno(1,2,3-cd)pyrene	7.90E-01	mouse	3.31E-03	2.50E-02	1.05E-01	3.20E+00	N

TABLE 7-12

SOIL SCREENING AGAINST ECOLOGICAL TOXICITY SCREENING BENCHMARKS
SUBSURFACE SOIL

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Constituent	Maximum Detected Conc. (mg/kg)	Test Organism	Feeding Rate [1] (kg/d)	Body Weight [1] (kg)	Soil Screening Intake [2] (mg/kg/d)	Toxicity Screening Benchmark[3] (mg/kg/d)	Intake Exceeds Toxicity Screening Benchmark[4] (Y/N)
n-Nitrosodiphenylamine (1)	9.50E-02	mouse	3.31E-03	2.50E-02	1.26E-02	6.02E+01	N
Naphthalene	3.70E-02	mouse	3.31E-03	2.50E-02	4.90E-03	2.66E+01	N
Pentachlorophenol	9.90E-01	rat	2.55E-02	3.00E-01	8.42E-02	2.40E-01	N
Phenanthrene	3.60E-01	mouse	3.31E-03	2.50E-02	4.77E-02	3.20E+00	N
Pyrene	1.20E+00	mouse	3.31E-03	2.50E-02	1.59E-01	3.20E+00	N
bis(2-Chloroisopropyl) ether	4.10E-01	mouse	3.31E-03	2.50E-02	5.43E-02	3.58E+01	N
bis(2-Ethylhexyl)phthalate	1.30E+00	rat	2.55E-02	3.00E-01	1.11E-01	2.00E+00	N
Pesticides							
4,4'-DDD	1.50E-02	mouse	3.31E-03	2.50E-02	1.99E-03	1.07E+02	N
4,4'-DDE	1.40E-01	mouse	3.31E-03	2.50E-02	1.85E-02	3.40E+01	N
4,4'-DDT	1.60E-02	mouse	3.31E-03	2.50E-02	2.12E-03	2.60E+00	N
Aldrin	1.90E-03	rat	2.55E-02	3.00E-01	1.62E-04	2.00E-01	N
Aroclor-1254	6.10E-02	oldfield mouse	1.74E-03	1.20E-02	8.85E-03	1.36E-01	N
Aroclor-1260	2.80E-02	oldfield mouse	1.74E-03	1.20E-02	4.06E-03	1.36E-02	N
Dieldrin	8.00E-02	rat	2.55E-02	3.00E-01	6.80E-03	4.00E-02	N
Endosulfan I	4.30E-01	mouse	3.31E-03	2.50E-02	5.69E-02	2.50E+00	N
Endosulfan sulfate	2.00E-02	mouse	3.31E-03	2.50E-02	2.65E-03	2.50E-01	N
Endrin	4.30E-02	mouse	3.31E-03	2.50E-02	5.69E-03	8.40E-02	N
Endrin ketone	7.10E-02	mouse	3.31E-03	2.50E-02	9.40E-03	8.40E-03	**Y**
Heptachlor epoxide	1.10E-03	rat	2.55E-02	3.00E-01	9.35E-05	1.20E-01	N
alpha-Chlordane	1.10E-03	mouse	3.31E-03	2.50E-02	1.46E-04	1.00E-01	N
beta-BHC	2.00E-02	rat	2.55E-02	3.00E-01	1.70E-03	8.00E-01	N
delta-BHC	2.20E-03	rat	2.55E-02	3.00E-01	1.87E-04	1.60E+00	N
Herbicides							
MCPA	3.40E+01	rat	2.55E-02	3.00E-01	2.89E+00	3.04E-01	**Y**

TABLE 7-12

SOIL SCREENING AGAINST ECOLOGICAL TOXICITY SCREENING BENCHMARKS SUBSURFACE SOIL

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Constituent	Maximum Detected Conc. (mg/kg)	Test Organism	Feeding Rate [1] (kg/d)	Body Weight [1] (kg)	Soil Screening Intake [2] (mg/kg/d)	Toxicity Screening Benchmark[3] (mg/kg/d)	Intake Exceeds Toxicity Screening Benchmark[4] (Y/N)
Metals							
Antimony	5.20E+01	mouse	3.31E-03	2.50E-02	6.88E+00	3.50E-01	Y
Arsenic	1.61E+01	mouse	3.31E-03	2.50E-02	2.13E+00	1.10E+00	Y
Barium	5.24E+02	rat	2.55E-02	3.00E-01	4.45E+01	5.06E+00	Y
Cadmium	2.50E+01	mouse	3.31E-03	2.50E-02	3.31E+00	1.14E+01	N
Copper	8.37E+02	mouse	3.31E-03	2.50E-02	1.11E+02	1.42E+01	Y
Lead	6.27E+03	rat	2.55E-02	3.00E-01	5.33E+02	8.00E+00	Y
Mercury	1.00E+00	mouse	3.31E-03	2.50E-02	1.32E-01	3.00E-02	Y
Selenium	1.70E+00	mouse	3.31E-03	2.50E-02	2.25E-01	1.50E-01	Y
Silver	9.00E+00	mouse	3.31E-03	2.50E-02	1.19E+00	7.24E-01	Y
Zinc	1.53E+03	rat	2.55E-02	3.00E-01	1.30E+02	1.60E+02	N

[1] Body weight and feeding rate are based on the species used in the toxicity study from which the toxicity screening benchmark for this chemical was derived (see Table 7-10).

[2] Soil screening intake = (maximum concentration * feeding rate) / body weight.

[3] Toxicity screening benchmarks are calculated from toxicity values with appropriate EPA Region VIII uncertainty factors to derive a NOAEL equivalent value (see Table 7-10).

[4] Y = Soil screening intake exceeds toxicity screening benchmark, or no screening benchmark is available.
N = Soil screening intake is less than toxicity screening benchmark.

modified from those published by EPA Region VIII (EPA, 1994a), as shown in Table 7-10.

Toxicity tests and test endpoints used to develop the preliminary screening values for soil contaminants are shown in Table 7-10. Feeding rates and body weights of the animals used in the toxicity tests, as well as results of the toxicity screening, are shown in Tables 7-11 and 7-12.

b. Surface water screening using toxicity-based benchmarks

For surface water screening, the maximum concentration of each detected analyte was compared to NYSDEC Ambient Water Quality Standards and Guidance Values (NYSDEC, 1993a). For chemicals with no NYSDEC screening value, screening values developed by Headquarters EPA (EPA, 1996c) were used. The values, termed Ecotox Thresholds, were developed for screening Superfund-type hazardous waste sites. For chemicals with neither a NYSDEC nor Ecotox Threshold screening value, surface water screening benchmarks developed by EPA Region IV for hazardous waste sites (EPA, 1995) were used. Screening for chemicals detected in surface water is shown in Table 7-13.

c. Sediment screening using toxicity-based benchmarks.

For sediment screening, the maximum concentration of each detected analyte was compared to NYSDEC benchmarks presented in *Technical Guidance for Screening Contaminated Sediments* (NYSDEC, 1993b). For chemicals with no NYSDEC screening value, Ecotox Threshold screening values developed by Headquarters EPA (EPA, 1996c) were used. For chemicals with neither a NYSDEC nor Ecotox Threshold screening value, sediment screening benchmarks developed by EPA Region IV for hazardous waste sites (EPA, 1995) were used. Screening for chemicals detected in sediment is shown in Table 7-14.

d. Previously eliminated constituents, media, or exposure groups were evaluated to determine whether they should be re-included due to historical information or considerations such as mobility, bioaccumulation, persistence, and toxicity. No eliminated constituents, media, or exposure groups were re-included.

TABLE 7-13

SCREENING AGAINST ECOLOGICAL TOXICITY SCREENING BENCHMARKS
SURFACE WATER

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Constituent	Units	Maximum Detected Concentration	Freshwater Screening Value	Source	Maximum Exceeds Screening Value (Y/N)[1]
Semivolatile Organics					
bis(2-Ethylhexyl)phthalate	UG/L	2.00E+00	6.00E-01	(2)	Y
Metals					
Antimony	UG/L	2.36E+01	1.60E+02	(4)	N
Arsenic	UG/L	4.60E+00	1.90E+02	(2)	N
Barium	UG/L	1.00E+02	3.90E+00	(3)	Y
Cadmium	UG/L	1.30E+00	1.90E+00	(2)	N
Chromium	UG/L	1.00E+00	3.50E+02	(2)	N
Copper	UG/L	3.27E+01	2.00E+01	(2)	Y
Iron	UG/L	3.22E+02	3.00E+02	(2)	Y
Lead	UG/L	3.71E+01	7.20E+00	(2)	Y
Manganese	UG/L	1.96E+01	8.00E+01	(3)	N
Nickel	UG/L	1.70E+00	1.54E+02	(2)	N
Selenium	UG/L	3.50E+00	1.00E+00	(2)	Y
Vanadium	UG/L	1.80E+00	1.40E+01	(2)	N
Zinc	UG/L	6.17E+01	1.40E+02	(2)	N

[1] Y = Maximum sediment concentration exceeds screening benchmark, or no benchmark is available.
N = Maximum sediment concentration is less than screening benchmark.

(2) NYS Ambient Water Quality Standard for Class C waters

(3) EPA Ecotox Thresholds (EPA, 1996).

(4) EPA Region IV Freshwater Surface Water Screening Values for Hazardous Waste Sites (EPA, 1995).

For hardness dependent metals (cadmium, chromium, copper, lead, nickel, and zinc) the Class C standard was calculated using an average value of 188.18 mg/L $CaCO_3$.

TABLE 7-14

SCREENING AGAINST ECOLOGICAL TOXICITY SCREENING BENCHMARKS
SEDIMENT

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Constituent	Units	Maximum	Sediment	Source	Maximum Exceeds
Volatiles					
Acetone	mg/kg	2.60E-02	none avail		Y
Toluene	mg/kg	8.00E-03	6.70E-01	(3)	N
Semivolatiles					
2,4-Dimethylphenol	mg/kg	3.20E-02	7.05E-05	(2)	Y
2,4-Dinitrotoluene	mg/kg	4.50E-01	none avail		Y
Benzo(a)anthracene	mg/kg	2.50E-02	3.30E-01	(5)	N
Benzo(a)pyrene	mg/kg	3.00E-02	7.65E+00	(3)	N
Benzo(b)fluoranthene	mg/kg	4.30E-02	3.30E-01	(5)	N
Benzo(ghi)perylene	mg/kg	3.10E-02	3.30E-01	(5)	N
Benzo(k)fluoranthene	mg/kg	3.30E-02	3.30E-01	(5)	N
Chrysene	mg/kg	4.80E-02	3.30E-01	(5)	N
Fluoranthene	mg/kg	7.00E-02	1.82E+01	(2)	N
Indeno(1,2,3-cd)pyrene	mg/kg	2.40E-02	3.30E-01	(5)	N
Phenanthrene	mg/kg	3.50E-02	2.14E+00	(2)	N
Pyrene	mg/kg	4.70E-02	1.17E+01	(3)	N
bis(2-Ethylhexyl)phthalate	mg/kg	7.70E-02	3.55E+00	(2)	N
Pesticides/PCBs					
4,4-DDD	mg/kg	1.30E-02	7.90E-03	(2)	Y
4,4'-DDE	mg/kg	6.20E-02	1.78E-02	(2)	Y
4,4'-DDT	mg/kg	1.20E-02	1.78E-02	(2)	N
Dieldrin	mg/kg	5.00E-03	1.60E+00	(2)	N
Endosulfan I	mg/kg	1.60E-03	5.34E-04	(2)	Y
Endosulfan II	mg/kg	3.80E-03	3.84E-04	(2)	Y
Metals					
Aluminum	mg/kg	2.21E+04	none avail		Y
Antimony	mg/kg	5.50E+00	2.00E+00	(4)	Y
Arsenic	mg/kg	7.50E+00	6.00E+00	(4)	Y
Barium	mg/kg	1.62E+02	none avail		Y
Beryllium	mg/kg	9.90E-01	none avail		Y
Cadmium	mg/kg	4.80E+00	6.00E-01	(4)	Y
Chromium	mg/kg	2.77E+01	2.60E+01	(4)	Y
Cobalt	mg/kg	1.78E+01	none avail		Y
Copper	mg/kg	3.09E+02	1.60E+01	(4)	Y
Iron	mg/kg	3.50E+04	2.00E+04	(4)	Y
Lead	mg/kg	1.05E+03	3.10E+01	(4)	Y
Manganese	mg/kg	7.68E+02	4.60E+02	(4)	Y
Mercury	mg/kg	1.60E-01	1.50E-01	(4)	Y
Nickel	mg/kg	3.16E+01	1.60E+01	(4)	Y
Selenium	mg/kg	1.90E+00	none avail		Y
Thallium	mg/kg	1.30E+00	none avail		Y
Vanadium	mg/kg	3.38E+01	none avail		Y
Zinc	mg/kg	2.78E+02	1.20E+02	(4)	Y

[1] Y = Maximum sediment concentration exceeds screening benchmark, or no benchmark is available.
N = Maximum sediment concentration is less than screening benchmark.

(2) NYSDEC Equilibrium Partitioning method based on % organic carbon in sample with maximum detected analyte concentration.

(3) EPA Ecotox Thresholds (EPA, 1996).

(4) Lowest Effect Level is the lower of either Persaud et. al (1992) or Long and Morgan (1990).

(5) EPA Region IV Sediment Screening Values for Hazardous Waste Sites (EPA, 1995).

e. For each medium and/or exposure group, it was determined whether there are any COPCs remaining. If no COPCs remained, the medium and/or exposure group was dropped from further consideration in the ERA.

f. The constituents and exposure routes that were retained after the application of this process were then selected for use as the starting point of the ecological risk analysis. These COPCs, with the maximum and RME concentration of each, are shown in Table 7-15.

While the maximum concentration of a chemical in each medium is appropriate for a conservative screening step, the maximum concentration is an overly conservative representation of an exposure point concentration for the remainder of the ecological risk analysis. An exposure point concentration is the concentration of a COPC in an environmental medium at the location where a receptor contacts the medium. Exposure point concentrations were calculated based on the reasonable maximum exposure (RME) concentration, a conservative concentration that is still within the range of possible exposures, for each complete pathway. Sampling data collected during characterization investigations at the site were used to calculate the exposure point concentrations of COPCs identified in surface soil, subsurface soil, surface water, and sediment. Groundwater was not considered, as there is no complete exposure pathway for receptors to groundwater.

Surface soil sampling data were used to estimate exposure point concentrations of COPCs at SEAD-17 for current land use conditions. Data included surface soil samples from a depth of 0 to 0.5 ft. Risk from soil exposure under future land use conditions was estimated based on exposure point concentrations in soil from a depth of 0 to 4 ft, to allow for the possibility of future excavation of deeper soils to the surface as a result of human activities such as construction or farming. Concentrations of COPCs measured in surface water in the drainage ditches of SEAD-17 were used to estimate exposure point concentrations in surface water (assuming a constant concentration over time) for both the current and future conditions. Sediment exposure point concentrations were estimated from measured concentrations of COPCs in sediment in the drainage ditches for both current and future conditions.

The same exposure point concentrations (EPCs) derived for the human health risk assessment were used as the RME concentrations for this ecological risk assessment. See Section 7.2.4 for a discussion of the calculations of EPCs, and Table 7-3 for a complete list of site EPCs.

Table 7-15

ECOLOGICAL CHEMICALS OF POSSIBLE CONCERN

SEAD 17 Remedial Investigation
Seneca Army Depot Activity

COPC	Surface Soil		Subsurface Soil		Surface Water		Sediment	
	Max Conc (mg/kg)	RME Conc (mg/kg)	Max Conc (mg/kg)	RME Conc (mg/kg)	Max Conc (ug/L)	RME Conc (ug/L)	Max Conc (mg/kg)	RME Conc (mg/kg)
Volatiles								
Acetone	(a)	(a)	(a)	(a)	(a)	(a)	2.60E-02	1.44E-02
Semivolatiles								
2,4-Dimethylphenol	(a)	(a)	(a)	(a)	(a)	(a)	3.20E-02	3.20E-02
2,4-Dinitrotoluene	(a)	(a)	(a)	(a)	(a)	(a)	4.50E-01	3.14E-01
Dibenzofuran	3.60E-02	3.60E-02	3.60E-02	3.60E-02	(a)	(a)	(a)	(a)
bis(2-Chloroisopropyl)ether	4.10E-01	2.13E-01	4.10E-01	2.13E-01	(a)	(a)	(a)	(a)
bis(2-Ethylhexyl)phthalate	(a)	(a)	(a)	(a)	2.00E+00	2.00E+00	(a)	(a)
Pesticides								
4,4'-DDD	(a)	(a)	(a)	(a)	(a)	(a)	1.30E-02	6.46E-03
4,4'-DDE	(a)	(a)	(a)	(a)	(a)	(a)	6.20E-02	4.82E-02
Endrin ketone	7.10E-02	2.93E-03	7.10E-02	2.73E-03	(a)	(a)	(a)	(a)
Endosulfan I	(a)	(a)	(a)	(a)	(a)	(a)	1.60E-03	1.43E-03
Endosulfan II	(a)	(a)	(a)	(a)	(a)	(a)	3.80E-03	3.05E-03
Herbicides								
MCPA	3.40E+01	8.49E+00	3.40E+01	6.26E+00	(a)	(a)	(a)	(a)

Table 7-15

ECOLOGICAL CHEMICALS OF POSSIBLE CONCERN

SEAD 17 Remedial Investigation
Seneca Army Depot Activity

COPC	Surface Soil		Subsurface Soil		Surface Water		Sediment	
	Max Conc (mg/kg)	RME Conc (mg/kg)	Max Conc (mg/kg)	RME Conc (mg/kg)	Max Conc (ug/L)	RME Conc (ug/L)	Max Conc (mg/kg)	RME Conc (mg/kg)
Metals								
Aluminum	(a)	(a)	(a)	(a)	(a)	(a)	2.21E+04	1.83E+04
Antimony	(a)	(a)	5.20E+01	9.89E+00	(a)	(a)	5.50E+00	5.50E+00
Arsenic	1.61E+01	6.44E+00	1.61E+01	6.21E+00	(a)	(a)	7.50E+00	6.10E+00
Barium	5.24E+02	1.67E+02	5.24E+02	1.53E+02	1.00E+02	7.22E+01	1.62E+02	1.32E+02
Cadmium	(a)	(a)	(a)	(a)	(a)	(a)	4.80E+00	2.40E+00
Chromium	(a)	(a)	(a)	(a)	(a)	(a)	2.77E+01	2.47E+01
Cobalt	(a)	(a)	(a)	(a)	(a)	(a)	1.78E+01	1.26E+01
Copper	8.37E+02	2.21E+02	8.37E+02	1.76E+02	3.27E+01	1.93E+01	3.09E+02	1.33E+02
Iron	(a)	(a)	(a)	(a)	3.22E+02	1.93E+01	3.50E+04	2.94E+04
Lead	6.34E+03	2.25E+03	6.27E+03	2.46E+03	3.71E+01	3.71E+01	1.05E+03	6.83E+02
Manganese	(a)	(a)	(a)	(a)	(a)	(a)	7.68E+02	5.32E+02
Mercury	1.00E+00	1.31E-01	1.00E+00	1.15E-01	(a)	(a)	1.60E-01	8.11E-02
Nickel	(a)	(a)	(a)	(a)	(a)	(a)	3.16E+01	3.16E+01
Selenium	1.70E+00	1.03E+00	1.70E+00	6.98E-01	3.50E+00	3.23E+00	1.90E+00	1.27E+00
Silver	9.00E+00	2.06E+00	9.00E+00	1.65E+00	(a)	(a)	(a)	(a)
Thallium	1.50E+00	6.38E-01	(a)	(a)	(a)	(a)	1.30E+00	8.24E-01
Vanadium	(a)	(a)	(a)	(a)	(a)	(a)	3.38E+01	2.97E+01
Zinc	(a)	(a)	(a)	(a)	(a)	(a)	2.78E+02	1.88E+02

(a) Constituent is not a COPC in this medium

7.6.2.2 Site Habitat Characterization

Site-specific data were compiled regarding the types of habitats and wildlife species found in the site vicinity. With the exception of fish collection for species identification, no biological sample collection or inventory was conducted for the Tier 1 ERA. The area considered likely to exhibit an interaction between elements of the local ecology and site-related contaminants occurs within a 2-mile radius of the site property. Due to land use patterns and geography within the 2-mile radius, evaluation of ecological resources and habitats is focused more on areas of potential exposure rather than on arbitrary distances or boundaries that lack a biological justification (EPA, 1989). Multiple site visits were conducted during October 1996 to evaluate the habitat conditions within the radius of concern. A general evaluation of ecological resources and land use patterns within a 2-mile radius was conducted in conjunction with the site inspection. A general vegetative cover type map was prepared for areas within a 2-mile radius of the site and is presented in Figure 3-8. A more detailed vegetative cover type map of the 0.5-mile radius is presented in Figure 3-9. Observations and assessments were concentrated on undeveloped areas, waterways, and wetlands on and adjacent to the site. Vegetative classifications used in this assessment are based on NYSDEC Natural Heritage Program *Ecological Communities of New York State* (Reschke, 1990)

Information presented in this section was acquired by a combination of literature review, file searches, telephone interviews, office visits, and site inspection. Information was obtained from various departments of the NYSDEC including the headquarters in Albany, NY, the Region 8 offices in Avon NY, the Wildlife Resources Center in Latham, NY, the NYSDEC Bureau of Monitoring and Assessment Ambient Surface Water Monitoring Program, and the Rotating Intensive Basin Survey. Information was also obtained from the Albany headquarters of the New York State Department of Health (NYSDOH), the State University of New York College of Environmental Science and Forestry (SUNY ESF), Cornell University, the US Fish and Wildlife Service (USFWS), the US Geological Survey Water Resources Division, and from publications of the Society of American Foresters. Site-specific resource information was acquired from the Seneca Army Depot *Natural Resources Management Plan* (SEDA, 1992c) and *Wetlands, Fish and Wildlife Plan* (SEDA, 1995). Regional information was obtained from the USGS 7 1/2 minute Romulus and Ovid, NY topographic maps; New York State Article 24 Freshwater Wetlands maps; the US Fish and Wildlife Service National Wetlands Inventory the US Department of Agriculture (USDA) Natural Resources Conservation Service (formerly, Soil Conservation Service); and the US Commerce Department *Climatic Atlas of the United States* (US Department of Commerce, 1983).

7.6.2.2.1 Regional Climate

Weather conditions in Seneca County exhibit seasonal fluctuations in temperature, precipitation, and prevailing winds. The climate in the region consists of moderately cold winters and warm, humid summers. The region exhibits a frost-free season of 135 days and a growing season of approximately 165 to 180 days (NOAA, 1990). Lake Ontario has a regional moderating effect on both daytime highs and nighttime low temperatures. Frost-free season length increases with proximity to the lake. Monthly precipitation in Seneca County is relatively uniform with no well-defined wet or dry seasons. The lightest precipitation commonly occurs in winter and the heaviest in late spring to midsummer. In 7 years in 10, total annual precipitation ranges from 26.5 to 37.5 inches. Rainfall during the May through September growing season is ordinarily 14.5 to 15.5 inches. Summer temperatures of 90°F or higher occur from 8 to 15 days in most years, mostly in June, July, and August. Average seasonal snowfall is 60 to 65 inches. Most days from early December through mid-March have at least 1 inch of snow cover on the ground (USDA, 1972).

7.6.2.2.2 Terrestrial Physical Characteristics

The Seneca Army Depot is situated due west of the village of Romulus, NY and 12 miles south of the villages of Geneva and Seneca Falls, NY. The site lies within the area described in the *Atlas of Forestry in New York* as the 1,400,000-acre Eastern Lake Plains region at the edge of the Allegheny Plateau (Society of American Foresters, 1973). The Allegheny Plateau exhibits irregular and broadly rolling topography in a complex pattern of high, rounded ridges flanked by steep, irregular valleys with elevations ranging from 500 to 2,500 feet. The Seneca Army Depot occupies 10,587 acres of a high, broad plateau separating Cayuga Lake, to the east, and Seneca Lake, to the west. Topography across the depot slopes gently from 765 feet at the southeast corner to 585 feet at the northwest corner.

The SEAD-17 site consists of an essentially flat fill area measuring roughly 350 feet by 350 feet, a total area of approximately 2.8 acres. The site is occupied by the deactivation furnace (building 367). The surface of the site exhibits very poor soil development and consists mostly of gravel and crushed shale, along with concrete and asphalt pavement. Topography surrounding the site is graded essentially flat to facilitate vehicular access.

Four watersheds are present on the depot (USDA, 1989). Kendaia Creek drains the central portion of the site westward into Seneca Lake. Reeder Creek drains the northwest and north-central regions of the facility. The northeast portion of the site drains into Kendig Creek, which flows north into the Cayuga-Seneca Canal. The southern part of the depot is drained by Indian

Creek, which empties into Seneca Lake near Sampson State Park. The SEAD-17 site is located in the headwaters region of the Kendaia Creek watershed.

The site is filled and graded, allowing no standing water to accumulate on the ground surface. Surface water runoff is collected primarily in a ditch that carries surface runoff to the southwest. The ditch is tributary to Kendaia Creek at a point approximately 700 to 800 feet southwest of the site.

7.6.2.2.3 Land Use and Vegetative Cover

Land use at the depot is controlled by the facility mission. The entire facility has restricted access and is surrounded by chain-link fencing topped with barbed wire. The depot has a roadway network consisting of paved macadam, concrete, and gravel roads totaling approximately 141 miles.

Land use is divided into three categories at the depot. The Main Post accounts for 9,832 acres and consists of an exclusion area containing partially buried, reinforced concrete igloos, general storage magazines, and warehouses. The cantonment areas of the facility consist of the North and South Posts. The North Post, at the north end of the Main Post, includes troop housing, troop support, and community services. The South Post is located in the southeast portion of the facility near Route 96 and is a developed area containing warehouses, administration buildings, quarters, and community services.

SEAD-17 is located at the western edge of the South Post area and adjoins the Main Post (ammunition area) perimeter fence. Land use at SEAD-17 consists of an abandoned building, storage lots, and derelict structures. Access to the site is restricted by perimeter chain link fencing.

The vegetative communities within the 0.5-mile study area are predominantly upland cover types unevenly distributed among the developed areas of the South Post. Vegetation and land use within the 0.5-mile radius study area are depicted in Figure 3-9. Cover types include mown lawns, old fields, shrublands, and deciduous forest. Unvegetated areas consist of open storage lots, railroads, paved roads, and buildings. Unvegetated corridors are maintained by herbicide application along the railroad tracks adjacent to the site.

On-site vegetation is sparse. Only a few specimens of common weeds have been able to establish root systems in the compacted fill soils at the site. No shrub or tree strata are present. Vegetation consists of grasses and early successional herbaceous species, primarily spotted knapweed (*Centaurea maculosa*), orchard grass (*Dactylis glomerata*), and various other grasses. These species occupy approximately 5 percent of the ground surface of the site. A listing of observed plant species and community associations at the site and within the 0.5-mile study area is presented in Table 3-4.

The types and distribution of vegetative communities surrounding the site result from decades of human modification of the environment of South Post and the ammunition area (Main Post) (SEDA, 1992a, c). Mowing, drainage diversion, building construction, landscaping practices, forestry practices, plantations, and herbicide application all control the composition of vegetation surrounding the site. The following sections describe the vegetation and ecological community types that were observed within the 0.5-mile study area. Classification of the communities is presented consistent with the approach presented in *Ecological Communities of New York State* (Reschke, 1990).

Upland Forest Communities

Appalachian Oak-Hickory Forest. This cover type represents a relatively minor component within the 0.5-mile study area in small, undisturbed remnant forests, bisected by ammunition area roads. These forests usually exhibit nearly complete canopy cover; abundant mast-bearing trees; and a shaded, sparse understory. The oak-hickory forests within the subject area are composed of northern red oak (*Quercus rubra*), white oak (*Quercus alba*), shagbark hickory (*Carya ovata*), and black walnut (*Juglans nigra*). The shrub stratum is dominated by saplings of these species as well as red maple (*Acer rubrum*), hawthorn (*Crataegus* sp.), butternut (*Juglans cinerea*), and vines of wild grape (*Vitis* sp.), poison ivy (*Toxicodendron radicans*), and raspberry (*Rubus idacus*).

Successional Northern Hardwoods. Successional northern hardwoods are present in areas where sufficient time has elapsed since disturbance to facilitate the development of a dense overstory canopy (75 percent cover). Particularly even-aged stands of red maple within this forest type are possibly deliberate plantations. Dominant overstory trees are red maple, eastern cottonwood (*Populus deltoides*), and northern red oak.

Conifer Plantation. The single occurrence of this vegetation type consists of a tamarack (*Larix laricina*) monoculture plantation located between the ammunition area roads B9 and C1, near the western fringe of the 0.5-mile radius. Small diameter tamaracks closely spaced at intervals occupy a plot in the area between the roadways. Close spacing and invasion of the understory by oldfield species appears to be limiting the prospects for this stand to mature into a significant covertype. While some scattered tamarack are present in surrounding cover types, they are apparently not vigorous enough to compete with fast-growing oldfield species and are exhibiting sparse new growth.

Deciduous tree plantation. Plantations of butternut and red maple appear to have been planted in the past, probably to create vegetative diversity and forage. Butternut stands, because of phytotoxins in the husks of their fruit, deter plant growth and exhibit a suppressed understory. Much of the shrub layer under the butternuts consists of only one species, raspberry, which appears to tolerate the altered soil chemistry.

Terrestrial Cultural Communities

Paved Roads and Mowed Roadside. Each of the ammunition area roadways has a paved width of 12 feet and has a mown and cleared margin of approximately 30 feet in width. Vegetative growth along site roads is maintained by mowing to provide suitable visibility and access, and to serve as fire breaks. No overstory or shrub layer is present within 30 feet of each edge of the asphalt pavement. Herbaceous growth is limited to grasses, sedges, and forbs able to withstand several mowings through the growing season.

Abandoned Structure Interior/Exterior. The abandoned building at SEAD-17 provides nesting habitat for barn swallows, roosting sites for bats, and shelter for small mammals. No other habitat utilization of the abandoned building was observed.

Ore Piles. Large ore piles consisting of ferro-manganese boulders/cobbles are present along the railroad sidings nearly 0.5 mile from the site. These ore piles offer no substrate for vegetation and are generally barren. Interstices near the ground surface may be exploited as shelter by small mammals. No significant habitat opportunities are otherwise offered in and around the ore stockpiles.

Railroads. Railroad tracks in the vicinity of the site were observed as being hunting grounds of red-tailed hawk and great horned owl during the field visits. Prominent perches adjacent to railroad corridors were occupied by these birds frequently during the site visits. Railroads apparently serve as trails for nocturnal creatures, as tracks and scat of skunk, raccoon, fox, and opossum were observed frequently. Poor rooting substrate and herbicide application suppress vegetation along the tracks and shoulders.

Palustrine Communities

The revised NYSDEC 1985 Article 24 Freshwater Wetlands map (Ovid, NY quadrangle) and USFWS National Wetlands Inventory (USFWS, 1991) map identify 32 freshwater wetlands within a 1-mile radius of the site. These wetlands are shown in Figure 3-10.

The nearest wetland (OV-8) identified on the 1985 NYS Article 24 Freshwater Wetlands map is located approximately 2,000 feet downstream, west of the site. Another NYS designated wetland (OV-5) occurs within the 0.5-mile radius study area, but is located outside the perimeter fence and occurs in an apparently upgradient position located on the opposite side of Route 96 from the SEAD property. A portion of NYS designated wetland OV-7 occurs within 1 mile of the site.

The USFWS NWI map depicts four wetland environments within 0.5 mile of the site and an additional 25 wetlands within a 1-mile radius. Wetlands systems within the 1-mile radius consist of palustrine forested, scrub-shrub, and emergent vegetative types and open water wetlands exhibiting several vegetative subclasses and hydrologic regimes.

Shallow emergent marshes, forested wetlands, and shrub swamps are depicted on Figure 3-10. Palustrine emergent marshes within 0.5 mile of the site are limited to the fringes of streams and ditches and result from diversion of naturally occurring drainage patterns. Forested wetlands result from disruption of local drainages and flooding caused by beaver dams.

Riverine Communities

The headwaters of Kendaia Creek are present in the site vicinity, approximately 800 feet to the south of SEAD-17. The creek is a first-order stream with a modified dendritic drainage pattern that drains to the west, across the ammunition area, then into Seneca Lake at Pontius Point. The upper reaches of Kendaia Creek have been modified (channeled and straightened) to facilitate better surface water runoff from the South Post. Unnamed tributaries from the SEAD-17 site contribute to the upper reaches of Kendaia Creek at the point where the creek enters the Ammunition Area (Main Post) from the South Post.

The watershed land use at the headwaters of the creek (South Post) is low-density industrial complex with maintained grades, stable soils, and adequate storm sewers, with little erosion potential. Further downstream, development is limited to ammunition storage bunkers in the ammunition area (Main Post). Approximately 500 feet downstream of the ammunition area/South Post fence, the creek is impounded by a series of three beaver dams.

Ditch/Artificial Stream. Kendaia Creek exhibits markedly different physical characteristics in modified and undisturbed sections. The upper, channelized sections are lined with steep unconsolidated banks of crushed shale fill. Canopy cover in the channelized portion is absent. Estimated stream width varies from 10 to 20 feet with depths ranging from 2 to 4 feet. Less than 10 percent of the substrate consists of rubble, gravel, or other stable habitat. Due to a series of three beaver dams downstream, the upper reaches of the creek are impounded into a pool condition dominated by a uniform velocity/depth category. Emergent vegetation occupies the inundated sections and a sparse shrub cover is present along the banks. The shale-fill banks end abruptly approximately 500 feet downstream of the South Post fence. This is the location of the first of a series of active beaver dams impounding water in this section of creek and the point where stream morphology changes greatly. The dams flood the forest along both banks of the creek .

Rocky Headwater Stream. The sections downstream of the first series of beaver dams differ in flow, depth, substrate, and canopy. Water velocity is greater, producing a scouring effect exposing shale bedrock, cobbles, pebbles, and coarse sands. Pools are small and shallow and most of the run is dominated by riffles. The canopy over the unmodified sections of the creek is dense and the banks are firmly anchored by a dense growth of shrubs. Organic matter consists chiefly of coarse leaf litter.

7.6.2.2.4 Aquatic Resources

Minnow traps deployed in the modified ditch, constituting the headwaters of Kendaia Creek, captured specimens of creek chub (*Semotilus atromaculatus*) and bluegill sunfish (*Lepomis macrochirus*). Captured creek chubs (17 specimens) ranged from 1.3 to 6 inches total maximum length. Ten bluegill sunfish captured ranged from 1 to 3 inches total length. These species were also observed in the downstream reaches. Tracks of piscivorous wading birds, probably great blue heron (*Ardea herodias*) and green-backed heron (*Butorides striatus*), were observed on the creek banks. Wood ducks (*Aix sponsa*) were observed in the pool area near the beaver dams. Green frog (*Rana clamitans melanota*) and northern leopard frog (*Rana pipiens*) were observed in various locations. Small fish were abundant in the upper reaches of the creek.

7.6.2.2.5 Stressed or Altered Vegetation

No adverse ecological effects were identified at the site that could be directly attributed to chemical contaminants. Direct evidence of contaminant stress on individual plants was not observed in the study area. No evidence of stunted, dead, or chlorotic vegetation was observed in the subject area. Examination of nearby surface waters yielded no indication of unusual colors, odors, precipitates, staining, or sheens. Natural gradients of plant succession and community composition would not be expected to be visible under the highly disturbed conditions prevalent at the site. It is therefore not possible to evaluate contaminant impacts in terms of vegetation type, abundance, or distribution. Bare areas scattered elsewhere on the site appeared directly attributable to very poor soil development in the surficial fill and are not considered a result of contaminant effects. No seeps or outbreaks of contaminated site drainage were noted along the perimeter of the site.

7.6.2.2.6 Wildlife Resources

Wildlife resources at the Seneca Army Depot are intensively managed under a cooperative conservation and development plan developed in conjunction with the NYSDEC (1992). The objectives of the fish and wildlife management plan are to:

a. protect and develop habitat for the production of game and non-game species;
b. control white-tailed deer (*Odocoileus virginianus*) harvest (with additional emphasis on white-tailed deer management);
c. enhance non-game species populations for their aesthetic, recreational, and educational values; and
d. establish long range goals for selected species including eastern bluebird (*Salia salis*), ring-necked pheasant (*Phasianus colchicus*), wood duck, white-tailed deer, and wild turkey (*Meleagris gallopavo*).

Commonly occurring small game mammals within the Main Post include eastern cottontail rabbit (*Sylvilagus floridanus*), gray squirrel (*Sciurus carolinensis*), raccoon (*Procyon lotor*), snowshoe hare (*Lepus americanus*), muskrat (*Ondatra zibithecus*), beaver (*Castor canadensis*), eastern coyote (*Canis latrans*), red fox (*Vulpes vulpes*), and gray fox (*Urocyon cinereoargenteus*). Ruffed grouse (*Bonasa umbellus*), ring-necked pheasant, and wild turkey also inhabit the depot. Waterfowl are attracted to wetlands on and around the depot, particularly the 87-acre "duck ponds" created in the northeast corner of the property during the 1970s.

The wildlife within 0.5 mile of the site consists of upland species, particularly those favoring old fields and shrublands and freshwater wetlands since these are abundant habitats in the study area. The mixture of these habitats with small woodlots and tree rows provides ideal habitat for white-tailed deer, which are common throughout the depot. Many non-game species also are present in the depot and potentially utilize habitats within the 0.5-mile study area.

Tracks, presumed to be of eastern coyote, coy-dog, or feral dog, were observed along the railroad sidings, west of the site. (While their tracks are often indistinguishable, no domestic dogs remain on the South Post since base closure.) Tracks of white-tailed deer, raccoon, and rabbit also were observed adjacent to the site. Wildlife evidence and direct observations made during site visits are presented in Table 3-4.

7.6.2.2.7 Endangered Species and Significant Habitats

The NYSDEC Natural Heritage Program Biological and Conservation Data System identifies no known occurrences of federal- or state-designated threatened or endangered plant or animal species within a 2-mile radius of the site. No species of special concern are documented within the depot property. Field investigation of the site determined that the surrounding area is highly modified and has a disturbed ecology resulting from management consistent with mission activities. Highly disturbed sites are characteristically colonized by pioneer species and agricultural "weeds" and do not typically support rare or endangered species. No rare or endangered plant species were observed during the site reconnaissance.

7.6.2.2.8 Habitat Assessment

Resource Values to Wildlife

The 9,832-acre Main Post is the focus of wildlife and forestry management practices being conducted at the depot. Wildlife management efforts focusing on waterfowl, songbirds, and game populations have been conducted for many years.

Overall, the small and highly-dissected meadow, forest, and oldfield habitats in the study area provide marginal habitat value. Extensive development and human traffic within the South Post likely deter wildlife utilization. Proximity to extensive mixed cover types of the Main Post probably enhances these habitats as foraging areas somewhat, and contributes diversity to the local environment.

The South Post is largely developed land that experiences indirect effects of the Main Post wildlife management strategies. For example, while the Main Post and South Post are separated by a chain link fence, breaches in the fence were observed to provide access to nocturnal grazing areas on South Post. White-tailed deer move to the South Post to graze lawns and gardens at night and return to the relative safety of the Main Post during the daylight hours. Many small mammals probably find the fencing no great barrier and may forage in a similar manner. Wildfowl and songbirds also may seek the Main Post solitude during the mid-day and seek foraging opportunities in the South Post during the early morning and evening. Landscaped lawns with exotic plantings, bird feeders, and garbage dumpsters offer foraging opportunities not available in the undeveloped Main Post. Wildlife management practices on the Main Post therefore have a spillover effect into the 0.5-mile study area of this ERA.

Wildlife and aquatic life that were observed within the 0.5-mile radius are presented in Table 3-4. In general, common wildlife species exploiting oldfield, successional forest, mature hardwood forest, and wetlands potentially occur within 0.5 mile of the site. Kendaia Creek and unnamed tributaries occur within the radius of concern and support a permanent aquatic community.

The habitat value of the SEAD-17 site itself is considered marginal. The surrounding perimeter fence excludes large mammals such as white-tailed deer, fox, and coyote. The gate over the access road reaches to within 6 inches of the ground surface and offers egress by small mammals such as rabbits, raccoons, and woodchucks (*Marmota monax*). No burrows were observed on the site. Mice, voles, and shrews would not be excluded by the perimeter fence. No mature trees are available for bird nesting or for dens. Ground-nesting birds preferring exposed gravel substrates, such as killdeer (*Charadrius vociferus*) may find suitable nesting conditions on the site, whereas tall grasses are too sparse to offer nesting habitat for ground nesters requiring concealment. Abundant evidence (tracks) of small mammals was observed in the pallet yard 300 feet northeast of the site. Human activity on and around the site probably discourages habitat utilization by some species.

Resource Value to Humans

The Seneca Army Depot represents a unique opportunity for wildlife and pest control research in New York state due to its large size and continuous perimeter fencing. The Depot property represents significant value to humans resulting from decades of wildlife management and scientific research. The NYSDEC has used the depot white-tailed deer population to develop population, growth, and reproduction models. Currently a 3-year Cornell University/NYSDEC white-tailed deer immuno-contraception study is being conducted with a captive herd in the Q area of the Main Post. NYSDEC biologists participate in annual harvests by inspecting field-dressed deer for disease and parasites, aging specimens, and measuring beam diameter (SEDA, 1992c). NYSDEC conducted studies in the 1960s on fox reproduction inhibition using diethyl stilbestrol (DES) to control the spread of rabies. Cornell University entomologists have conducted studies on the ability of northern corn rootworm to traverse areas of non-croplands at the Depot (SEDA, 1992c).

Consumptive use of wildlife consists of hunting of upland birds, predators, waterfowl, and white-tailed deer. Harvest of deer is closely monitored to maintain the population below carrying capacity of the Depot habitat (SEDA, 1995). Hunting on the property is presently limited to current and retired military personnel and limited numbers of guests. Hunting is conducted during both the Southern Zone archery and firearms hunting seasons in accordance with New York state regulations. Discontinuation of the military mission of the Depot may have significant impacts on the types and intensity of human utilization of wildlife resources in the future.

The consumptive wildlife resource value of the SEAD-17 property to humans is considered non-existent, due to the Post being posted and patrolled against unauthorized entry. Additionally, land use in the immediate vicinity of SEAD-17 is inconsistent with consumptive wildlife uses by the general public. Future use scenarios for the South Post property (excluding complete abandonment) are not likely to increase the suitability of habitat or wildlife resource value in the vicinity of SEAD-17.

Currently much of the South Post is vacant and access to the Depot is still restricted, thus limiting participation in non-consumptive wildlife uses. Evidence of non-consumptive wildlife resource utilization, such as bird watching, wildlife observation, photography, and amateur study, was not observed during the site inspection but is presumed to occur in the study area. The white-tailed deer population is an unusual herd that has an important aesthetic value. Due to breaches in the Main Post fence, white-tailed deer can be commonly observed in the South Post.

The drainages adjacent to the site do not provide exploitable fisheries resources. No recreational fishing resources are utilized within the 0.5-mile study area.

7.6.2.3 Ecological Assessment Endpoint(s)

EPA's draft *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (EPA, 1994b) states that the selection of assessment endpoints depends on the following:

1. The constituents present and their concentrations,
2. Mechanisms of toxicity to different groups of organisms,
3. Potential species present, and
4. Potential complete exposure pathways.

The constituents and concentrations are discussed in detail in Section 4. Mechanisms of toxicity are evaluated conceptually in the analysis plan in Section 7.6.2.4. Potential species present are discussed in Section 7.6.2.2 and receptor selection is presented in Section 7.6.2.3. Potential complete exposure pathways are part of the ecological conceptual site model in Section 7.6.2.3.

To assess whether significant adverse ecological effects have occurred or may occur at SEAD-17 as a result of ecological receptors' exposure to COPCs, ecological endpoints were selected. An ecological endpoint is a characteristic of an ecological component that may be affected by exposure to a stressor, such as a chemical. Assessment endpoints represent environmental values to be protected and generally refer to characteristics of populations and ecosystems (EPA, 1994b). Unlike the human health risk assessment process, which focuses on individual receptors, the ERA focuses on populations or groups of interbreeding non-human, non-domesticated receptors. In the ERA process, risks to individuals are assessed only if they are protected under the Endangered Species Act, as well as species that are candidates for protection or are considered rare.

Given the diversity of the biological world and the multiple values placed on it by society, there is no universally-applicable list of assessment endpoints. Therefore, EPA, in the *Proposed Guidelines for Ecological Risk Assessment* (EPA, 1996a) has suggested three criteria that should be considered in selecting assessment endpoints suitable for a specific ecological risk assessment. These criteria are: ecological relevance, susceptibility to the contaminant(s), and representation of management goals.

- <u>Ecological relevance.</u> The assessment endpoint should have biological/ecological significance to a higher level of the ecological hierarchy. Relevant endpoints help sustain the natural structure, function, and biodiversity of an ecosystem. For example, an increase in mortality or a decrease in fecundity of individuals is ecologically significant if it affects the size or productivity of the population. Likewise, a decrease in the size of a population is ecologically significant if it affects the number of species, the productivity, or some other property of the ecosystem.
- <u>Susceptibility to the contaminant(s)</u>. The assessment endpoint should be susceptible to exposure to the contaminant(s) and should be responsive/sensitive to such exposure. That is, assessment endpoints should be chosen that are likely to be exposed to contaminants at the site, either directly or indirectly (e.g., through the food chain), and they should be sensitive enough that such exposure may elicit an adverse response. Ideally, this sensitivity should be at such a level that other site-related receptors of potential concern are adequately protected under the selected endpoint's response threshold.

- Representation of management goals. The value of a risk assessment depends on whether it can support quality management decisions. Therefore the assessment is based on values and organisms that reflect management goals. The protection of ecological resources (e.g., habitats and species of plants and animals) is a principal motivation for conducting ERAs. Key aspects of ecological protection are presented as policy goals, which are general goals established by legislation or agency policy based on societal concern for the protection of certain environmental resources. For example, environmental protection is mandated by a variety of legislation and government agency policies (e.g., CERCLA, National Environmental Policy Act). Other legislation includes the Endangered Species Act, 16 U.S.C. 1531-1544 (1993, as amended) and the Migratory Bird Treaty Act, 16 U.S.C. 703-711 (1993, as amended). Table 7-16 shows the policy goals established for the site. To determine whether these protection goals are met at the site, assessment and measurement endpoints are formulated that define the specific ecological values to be protected and the degree to which each may be protected.

Given the small size of the site and its disturbed condition, it does not provide habitat for many species. The site ecological characterization concluded that SEAD-17 does not provide habitat for any threatened or endangered species; therefore, the assessment endpoint of no reduction in numbers of any threatened/endangered species is met. However, the field survey concluded that the site is likely to be used by small mammal populations and by fish populations in the site ditches. Accordingly, the assessment endpoint that has been selected to represent the policy goal of protection of terrestrial populations and ecosystems is "no substantial adverse effect on survival, growth, and reproduction of resident mouse populations." The survey of the surface water bodies at the site found creek chub living in the stream. The assessment endpoint selected to represent the policy goal of protection of aquatic populations and ecosystems is "no substantial adverse effect on survival, growth, and reproduction of resident fish populations."

7.6.2.3.1 Receptor Selection

Potential receptor species likely to be exposed to site-related contaminants were judged by the criteria identified in Section 7.6.2.3 as part of the assessment endpoint selection process. That is, receptors were selected to represent assessment endpoints based principally on their importance in the community food web; their susceptibility (through exposure and sensitivity) to the site-related constituents, the amount of available data describing their potential for exposure, and the toxicological effects that may result from exposure; and the extent to which they represent management goals. The results of this analysis indicate that native mouse species inhabiting the area of SEAD-17 are the most appropriate receptor species for soil, and the relevant assessment endpoint was defined as "no substantial adverse effect on resident mouse populations." Given

TABLE 7-16

POLICY GOALS, ECOLOGICAL ASSESSMENT AND MEASUREMENT ENDPOINTS AND DECISION RULES FOR SEAD-17

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Policy Goals	Assessment Endpoint	Measurement Endpoint	Decision Rule
Policy Goal 1: The conservation of threatened and endangered species (TES) and their critical habitats	**Assessment Endpoint 1:** No reduction in numbers of any state- or federally-designated TES	**Measurement Endpoint 1:** Biosurveys for TES plants and animals; COPC concentration in physical media and predicted concentration in prey species	**Decision Rule for Assessment Endpoint 1:** If TES are not present, or COPC RME concentrations in the media do not exceed toxicity screening thresholds or dietary NOAELS (i.e., HQ<1), the assessment endpoint is met and TES are not at risk
Policy Goal 2: The protection of terrestrial populations and ecosystems	**Assessment Endpoint 2:** No substantial adverse effect on populations of small mammals (i.e., deer mouse)	**Measurement Endpoint 2:** Lowest chronic, dietary, non-lethal effect level of COPCs on mice	**Decision Rule for Assessment Endpoint 2:** If ratios of estimated exposure concentrations predicted from COPC RME concentrations in soil to dietary limits corresponding to LOAEL toxicity reference values for adverse effects on deer mice (HQs) are <1, then Assessment Endpoint 2 is met and small mammals are not at risk
Policy Goal 3: The protection of aquatic populations and ecosystems	**Assessment Endpoint 3:** No substantial adverse effect on populations of aquatic animals (i.e., creek chub)	**Measurement Endpoint 3:** Lowest chronic non-lethal concentration of COPCs on fish	**Decision Rule for Assessment Endpoint 3:** If ratios of estimated exposure concentrations predicted from COPC RME concentrations in sediment and surface water to LOAEL toxicity reference values for adverse effects on fish (HQs) are <1, then Assessment Endpoint 3 is met and aquatic organisms are not at risk

COPC = constituent of potential concern.
TES = threatened and endangered species.
NOAEL = no observed adverse effect level.
LOAEL = lowest observed adverse effect level.
RME = reasonable maximum exposure.
HQ = hazard quotient.

the predominately herbaceous nature of the site, the deer mouse (*Peromyscus maniculatus*) was selected as the species with the niche best met by conditions present at the site. For the aquatic ecosystems, the native fish species in the streams were determined to be the most appropriate receptor species for surface water and sediment, and the relevant assessment endpoint was defined as "no substantial adverse effect on resident fish populations." The creek chub was selected as the species best representing the resident fish populations in the site streams.

While SEAD-17 is relatively poor habitat for mammals, deer mice have been observed at the site. These are the vertebrate receptors most likely to be maximally exposed to contaminants in soil at the site. They also represent a significant component of the food chain, feeding on seeds and berries and soil invertebrates and providing prey for predators. Therefore, the deer mouse was selected as the receptor species at this site and measures of effects (measurement endpoints) were selected that could be extrapolated to predict effects on the assessment endpoints. Data bases and available literature were searched for toxicity data for deer mice or other native rodent species. In the absence of site-specific data, laboratory-derived data on mortality or reproductive effects were used as measurement endpoints. In the absence of data on native species, data for laboratory rodents such as laboratory mice (*Mus musculus*) and laboratory rats (*Rattus norvegicus*) were used.

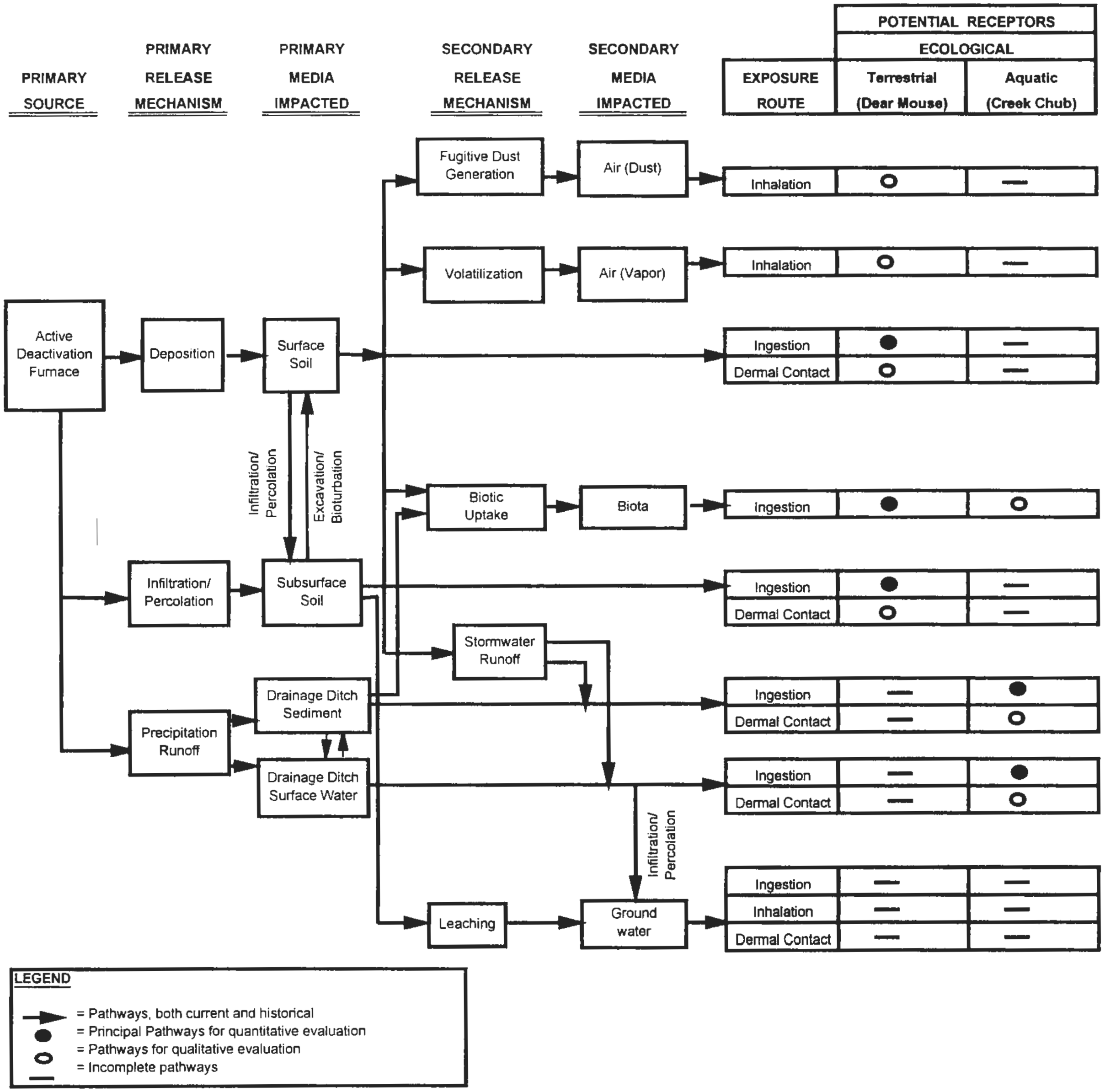
7.6.2.3.2 Ecological Conceptual Site Model

The conceptual site model (CSM) presents the ecological receptors at SEAD-17 that are potentially exposed to hazardous substances in soil across several pathways (Figure 7-7). A complete exposure pathway consists of the following four elements:

- A source and mechanism of contaminant release to the environment
- An environmental transport mechanism for the released contaminants
- A point of contact with the contaminated medium
- A route of contaminant entry into the receptor at the exposure point.

If any of these elements is missing, the pathway is incomplete and is not considered further in the ERA. A pathway is complete when all four elements are present and permit potential exposure of a receptor to a source of contamination. Quantification of some potentially complete pathways may not be warranted because of minimal risk contribution relative to other major pathways. The dominant pathways from sources and exposure media through the food web to ecological receptors potentially exposed to ecological COPCs at the site are presented in Figure 7-7.

Figure 7-7 Ecological Conceptual Site Model
SEAD-17 RI
SENECA ARMY DEPOT ACTIVITY



EXPOSURE ROUTE	POTENTIAL RECEPTORS ECOLOGICAL Terrestrial (Dear Mouse)	 Aquatic (Creek Chub)
Inhalation	○	—
Inhalation	○	—
Ingestion	●	—
Dermal Contact	○	—
Ingestion	●	○
Ingestion	●	—
Dermal Contact	○	—
Ingestion	—	●
Dermal Contact	—	○
Ingestion	—	●
Dermal Contact	—	○
Ingestion	—	—
Inhalation	—	—
Dermal Contact	—	—

LEGEND

→ = Pathways, both current and historical
● = Principal Pathways for quantitative evaluation
○ = Pathways for qualitative evaluation
— = Incomplete pathways

The CSM will serve as a conceptual hypothesis for the exposure characterization, the objective of which is to gather information from which to determine the pathways and media through which ecological receptors may be exposed to COPCs. The exposure characterization typically involves determining the following (EPA, 1994b):

1. The ecological setting of the site
2. The inventory of constituents that are or may be present at the site
3. The extent and magnitude of the constituent concentrations present, along with spatial and temporal variability of those concentrations
4. The environmental fate and transport of the constituents.

The ecological setting is described in Section 7.6.2.2 and the inventory of extent and magnitude contaminants is presented in Section 4 on Nature and Extent of Contamination. Environmental fate of the COPCs and the potential exposure pathways are discussed in the following paragraphs.

The primary sources of contaminants in SEAD-17 are the residues that remained after activities at the deactivation furnace. The wastes handled at the site are listed in the human health BRA. The primary release mechanisms are deposition of ash from waste-burning and inadvertent deposition of waste materials on surface soils. Contamination, if present, can migrate due to bioturbation or excavation. Volatile compounds can move through the soils. Infiltrating rainwater can leach contaminants and transport them into groundwater, and surface water runoff can also carry contaminants onto adjacent soils or drainage ditches.

Exposure to surface soil contaminants may occur directly through ingestion, inhalation, and/or dermal contact. Chemicals also may migrate further in the environment by a variety of pathways following secondary release from surface soil and deeper soil. The following pathways result from these secondary release mechanisms:

- Suspension and dispersal by the wind of particulate contaminants or contaminants adsorbed to surface soil particles
- Direct volatilization of volatile organic compounds from surface soil to air
- Uptake of soil contaminants by terrestrial organisms
- Transport of chemicals to surface water and sediment by surface runoff of water and soil particles
- Uptake of surface water and sediment contaminants by aquatic organisms.

As shown in the CSM, there are five media through which ecological receptors could be exposed to site-related contaminants: air (dust and vapor), soil, surface water, sediment, and organisms in the food chain. An exposure point is a location where a receptor could potentially come into contact with a contaminated medium. An exposure route is the means by which a receptor comes into contact with a contaminated medium at an exposure point. Exposure to COPCs may occur through the routes of ingestion, inhalation, and dermal contact.

Probable exposure routes (i.e., potentially complete pathways) were identified for each medium based on the physical characteristics of the site and the potential ecological receptors that may occur there (see the previous description of the ecological setting). Exposure routes were also identified for ecological receptors. Principal pathways for which analytical data were available for quantitative evaluation of soil COPCs include: ingestion of soil and ingestion of other animals and plants that have accumulated contaminants. For sediment and surface water, principal pathways include direct contact with surface water and sediment, ingestion of surface water and sediment, and ingestion of other organisms that have accumulated contaminants.

Terrestrial animals could potentially be directly exposed to soil contaminants through ingestion of, dermal contact with, and/or inhalation from site soils. For species such as deer, raccoon, opossum, rabbits, rodents, and birds, such exposures would likely be associated with foraging activities. Burrowing species, such as rabbits, mice, moles, and shrews, would probably receive the greatest exposures among vertebrates. Invertebrates living on and within the soil also may experience significant exposures. Although ingestion is the principal soil exposure route, dermal contact also may be important, particularly for burrowing species. However, the limited dermal permeability data base available for ecological receptors and surrogate species precluded quantitative evaluation of the dermal exposure pathway.

Ecological receptors could potentially be exposed to site-related contaminants via the air medium. Contaminants in air may be in the form of vapor from volatile organic compounds, or in particulate form (as dusts or adsorbed to soil particles) suspended by wind. In either form, ecological receptors could be exposed to contaminants through inhalation. However, the lack of applicable inhalation toxicity data for ecological receptors or similar species precluded quantitative evaluation of potential risks.

Aquatic biota could be directly exposed to surface water and sediment contaminants through ingestion of and dermal and gill contact with surface water and sediment in the site ditches. Predators could also ingest contaminated biota.

Plants may be considered ecological receptors as well as a pathway or medium through which wildlife receptors can be exposed to contaminants. Plants may absorb site-related contaminants from soil through their roots. Contaminants absorbed by plants may then be transferred to wildlife when the plants are ingested for food. This exposure pathway was addressed by use of chemical-specific soil-to-plant uptake factors (obtained from the scientific literature) in the animal receptor exposure calculations. No plants on or near the site showed visible signs of stress during the field reconnaissance.

Under the future land use scenario for SEAD-17, it is assumed that contaminated soils would be excavated during construction and distributed on the ground surface. As under current conditions, ecological receptors could potentially be exposed to chemicals in soil through ingestion and dermal contact. Other exposure pathways also were assumed to remain essentially the same as under current conditions, except that possible inhalation exposures are likely to be reduced by paving and vegetation (e.g., lawns). The abundance and diversity of some ecological receptors on the site may likely be reduced due to the development.

7.6.2.4 Analysis Plan

The analysis plan is the final stage of problem formulation. In this step, risk hypotheses presented in the CSM are evaluated to determine how these hypotheses will be assessed using site-specific data. The analysis plan includes three categories of measures to evaluate the risk hypotheses identified in the CSM: measures of effect (also termed measurement endpoints), measures of exposure, and measures of ecosystem and receptor characteristics.

7.6.2.4.1 Measures of Effect

Measurement endpoints are measurable responses to a stressor that are related to the valued characteristics chosen as assessment endpoints (EPA, 1992). Assessment endpoints generally refer to characteristics of populations and ecosystems. It is usually impractical to measure changes in these characteristics as part of an assessment. Consequently, measurement endpoints are selected that can be measured and extrapolated to predict effects on assessment endpoints (EPA, 1992). The most appropriate measurement endpoint relating to the assessment endpoint is the lowest concentration of the constituent that, in chronic toxicity tests, is associated with non-lethal effects to a deer mouse or creek chub. Because the assessment endpoint focuses on maintenance of populations of deer mice and creek chubs, a measure of effect equivalent to "no effect" would be overly conservative, in that it would reflect protection of the individual, not the population. A more appropriate measure of effect, reflecting population level response, is the lowest non-lethal effect level. Toxicity data from tests that measure responses that influence reproduction, health, and longevity of the mouse and fish will conform with the assessment endpoint. Therefore, the lowest concentration of the constituent that produces such effects will be used as a measure of effects.

Reliable measures of effects are not available for each exposure route for each constituent. Effects from exposure through inhalation and dermal contact are not well developed for ecological receptors; consequently, these exposure routes are analyzed qualitatively.

The measures of ecosystem and receptor characteristics include such characteristics as the behavior and location of the receptor and the distribution of a contaminant, both of which may affect the receptor's exposure to the contaminant. The typical foraging area of the receptor as well as the quality of the habitat in the site have been considered in the estimation of exposure, as discussed in Sections 7.6.3.2 and 7.6.3.3.

7.6.2.4.2 Measures of Exposure

Measures of exposure are the amounts, in dosage or concentration, that the receptors are hypothesized to receive. These include concentrations of constituents in the impacted media and concentrations or dosages of the constituents to which the receptor is exposed.

Decision rules are specified for evaluating effects on the assessment endpoints. Table 7-16 shows the decision rules that describe the logical basis for choosing among alternative actions for the assessment endpoints based on the results of the measurement endpoints. Together, the assessment endpoint, measurement endpoint, and decision rule define the following:

- An entity (e.g., deer mouse or creek chub population)
- A characteristic of the entity (e.g., health of the individuals in the population)
- An acceptable amount of change in the entity (e.g., loss of no more than 20 percent of a population)
- A decision whether the protection goal is or is not met.

The results of the assessment will be presented in terms of hazard quotients (HQs). The HQ is the ratio of the measured or predicted concentration of an ecological COPC to which the receptors are exposed in an environmental medium, and the measured concentration that adversely affects an organism based on a toxicity threshold. If the measured concentration or estimated dose is less than the concentration or dose expected to have the potential to produce an adverse effect (i.e., the ratio of the two is less than 1), the risk is considered acceptable (protective of the ecological receptor). Any quotient greater than or equal to 1 indicates that the ecological COPC warrants further evaluation to determine the actual likelihood of harm. COCs are selected only after an additional weight-of-evidence evaluation of the conservatism of the exposure assumptions, toxicity values, and uncertainties is conducted.

7.6.2.4.3 Measures of Ecosystem and Receptor Characteristics

Section 7.6.3.4 discusses the toxicity values associated with the COPCs. Endpoints stated in terms of specific ecological receptors or exposure classes (groups of species exposed by similar pathways) often require data on the processes that increase or decrease the exposure concentration below or above the measured or predicted environmental concentration. Thus, some quotients incorporate exposure factors (e.g., dietary soil fractions and bioaccumulation factors). Section 7.6.3.3 discusses exposure factors for the site.

7.6.3 Exposure Assessment

The exposure assessment evaluates potential exposure of ecological receptors to site-related constituents through evaluation of the following:

- Description of the spatial distribution of COPCs (Section 7.6.3.1)
- Description of spatial and temporal distribution of ecological receptors (Section 7.6.3.2)
- Quantification of exposure that may result from overlap of these distributions (Section 7.6.3.3).

7.6.3.1 Constituent Distribution

The extent of measured chemical contamination at the site is restricted to the areas sampled within and adjacent to SEAD-17. Site-related contamination of soil located beyond the immediate vicinity of the site has not been confirmed. The area of the site is approximately 2.8 acres. The ditches have a combined length of approximately 1,200 linear feet.

The magnitude of constituent exposures that may be experienced by ecological receptors is affected by the degree of their spatial and temporal associations with the site, as discussed in Sections 7.6.3.2 and 7.6.3.3.

7.6.3.2 Receptor Distribution

The approximately 2.8-acre study area was characterized in terms of ecological communities and receptors that could potentially be exposed to site-related contaminants. The site itself consists of the Terrestrial Cultural type of vegetation community with the site ditches classified as Ditch/Artificial Stream.

A variety of factors may affect the extent and significance of potential exposures. Receptor exposures are affected by the degree of spatial and temporal association with the site. For example, the receptors' mobility may significantly affect their potential exposures to site-related contaminants. Many species may only inhabit the study area during seasonal periods (e.g., breeding season, non-migratory periods). Non-migratory species may remain in the vicinity throughout the year. These species, particularly those with longer life spans (and usually larger home ranges), have the greatest potential duration of exposure. However, species with small home range sizes have the greatest potential frequency of exposure. Other factors affecting exposures include habitat preference, behavior (e.g., burrowing, rooting, foraging), individual home range size (larger home ranges correspond to far less frequent use of study area), and diet. Diet is of particular importance in exposure as related to (1) food source availability (larger amount of preferred food sources equals a greater potential for receptor usage) and (2) bioaccumulative contaminants. Contaminants that bioaccumulate may also tend to biomagnify in the food chain. This is discussed in more detail in Section 7.6.3.3. As a result, predatory species at higher trophic levels may receive their most significant exposures through their prey. However, the possibility of a population of an upper trophic-level predator, or even an individual predator, utilizing the site as a primary source of food is considered extremely remote.

The deer mouse has a typical home range of approximately 0.15 acres (EPA, 1993). The SEAD-17 area of approximately 2.8 acres could constitute 100 percent of the home range of a deer mouse. The site drainage ditches, at approximately 1,200 linear feet, could provide 100 percent of the creek chub's home range.

7.6.3.3 Quantification of Exposure

Evaluation of the degree to which contaminant and receptor distributions (described in the previous two sections) coincide at the site indicated that the deer mouse is the receptor likely to have the greatest potential exposures to COPCs in soil and the creek chub to COPCs in surface water and sediment.

To quantify exposures of terrestrial receptors to each COPC, a daily intake of each constituent was calculated. Conversion of the environmental concentration of each COPC to an estimated daily intake for a receptor at the site was necessary prior to evaluation of potentially toxic effects. For terrestrial animal receptors, calculation of exposure intake rates relied upon determination of an organism's exposure to COPCs found in soil. Exposure rates for the deer mouse receptor were based upon ingestion of contaminants from this medium and also from consumption of other organisms. The ERA did not attempt to measure potential risk from dermal and/or inhalation exposure pathways given the insignificance of these pathways relative to the major exposure pathways (e.g., ingestion) and due to the scarcity of data available for these pathways.

The first step in measuring exposure rates for terrestrial wildlife was the calculation of food ingestion rates for the deer mouse receptor. The EPA's *Wildlife Exposure Factors Handbook* (EPA, 1993) includes a variety of exposure information for a number of avian, herptile, and mammalian species, including the deer mouse. Data are directly available for body weight, ingestion rate, and dietary composition for the deer mouse.

To provide conservative exposure rate calculations for the deer mouse, the mean body weight of 0.02 kg for the female deer mouse and the maximum food ingestion rate of 0.22 g/g-day (0.0044 kg/day) for a non-lactating mouse were used (EPA, 1993).

The *Wildlife Exposure Factors Handbook* (EPA, 1993) also presents average values for intake of animal matter and plant matter for the deer mouse as well as incidental soil ingestion. Soil ingestion has been measured at less than 2 percent of diet (Beyer et al., 1994). As might be expected based on the opportunistic habits of mice, the proportion of animal to plant matter in the diet varies from around 65 percent animal : 35 percent plant to 25 percent animal : 75 percent plant depending on season and region of the country. For this ERA, an approximate average of 50 percent animal : 50 percent plant was used, after subtracting the 2 percent for incidental soil ingestion. The dietary intakes calculated for this assessment are as follows:

Total Dietary Intake = 0.0044 kg food/day
Plant Matter Intake = 0.00216 kg plant matter/day
Animal Matter Intake = 0.00216 kg animal matter/day
Incidental Soil Intake = 0.000088 kg soil/day

A site-specific exposure dose of each COPC was calculated using a food chain uptake model consistent with EPA Region IV guidance (EPA, 1995). This algorithm accounts for exposure via incidental ingestion of contaminated soil, ingestion of plants grown in contaminated soil, and ingestion of lower trophic level animals associated with contamination. The exposure equation for soil is as follows:

$$ED_{soil} = [(C_s \times SP \times CF \times I_p) + (C_s \times BAF \times I_a) + (C_s \times I_s)] \times SFF / BW$$

where:

ED_{soil} = Soil exposure dose for terrestrial receptor (mg/kg/day)
C_s = RME concentration in soil (mg/kg)
SP = Soil-to-plant uptake factor (unitless)
CF = Plant wet-weight-to-dry-weight conversion factor (unitless) = 0.2 (used for SP values based on plant dry weight)
I_p = Receptor-specific ingestion rate of plant material (kg/day) = 0.00216 kg/day
BAF = Constituent-specific bioaccumulation factor (unitless)
I_a = Receptor-specific ingestion rate of animal material (kg/day) = 0.00216 kg/day
I_s = Receptor-specific ingestion rate of soil (kg/day) = 0.000088 kg/day
SFF = Site foraging factor (unitless) = 1 (see explanation below)
BW = Body weight (kg) = 0.02 kg

In evaluating the potential for a contaminant to pose ecological risk, it is important to consider its propensity for bioaccumulation even though its concentration in an environmental medium may be below toxic levels. Therefore, all COPCs were evaluated with regard to their ecological persistence and tendency to bioaccumulate.

Bioaccumulation is the process of absorption and retention of a substance by an organism due to both uptake from water (or other surrounding media) and uptake from ingested residues in food, soil, and/or sediment. It is quantified by the calculation of a bioaccumulation factor (BAF). Bioconcentration is a component of bioaccumulation, accounting only for the process of uptake from the surrounding medium (usually water). It is quantified by the calculation of a bioconcentration factor (BCF). Both BAFs and BCFs are proportionality constants relating the concentration of a contaminant in the tissues of an organism to the concentration in the surrounding environment (Amdur et al., 1991; EPA, 1989).

Bioaccumulation and bioconcentration may be a significant component of exposure to COPCs for the SEAD-17 receptors. For the deer mouse receptor, bioaccumulation was evaluated by means of contaminant-specific soil-to-plant uptake factors and BAFs. The soil-to-plant uptake factors were obtained from NRC (1992) and Baes et al. (1984) for metals and for organic compounds by using a regression equation from Travis and Arms (1988). The latter is based on the contaminant-specific octanol/water partition coefficient (log K_{ow}). BAFs were obtained from the scientific literature. Factors reflecting accumulation of COPCs in earthworms were preferentially selected, based on the feeding habits of the deer mouse receptor. Table 7-17 and 7-18 show values for soil-to-plant uptake factors and BAFs.

TABLE 7-17

CALCULATED SOIL RECEPTOR EXPOSURE SURFACE SOIL

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Constituent	RME Concentration (mg/kg)	SP[1]		BAF[2]		Deer Mouse Exposure (mg/kg/day) [3]
Semivolatiles						
Dibenzofuran	3.60E-02	1.72E-01	(5)	1.00E+00	(6)	4.72E-03
Pesticides						
Endrin ketone	2.93E-03	2.20E-02	(5)	2.50E-01	(9)	9.90E-05
Herbicides						
MCPA	8.49E+00	1.00E+00	(6)	1.00E+00	(6)	1.87E+00
Metals						
Arsenic	6.44E+00	4.00E-02	(11)	1.00E+00	(6)	7.29E-01
Barium	1.67E+02	1.50E-01	(11)	1.00E+00	(6)	1.93E+01
Copper	2.21E+02	4.00E-01	(11)	4.11E-01	(7)	1.27E+01
Lead	2.25E+03	5.80E-03	(11)	3.41E-01	(8)	9.32E+01
Mercury	1.31E-01	9.00E-01	(11)	2.30E+01	(12)	3.29E-01
Selenium	1.03E+00	2.50E-02	(11)	4.70E-01	(14)	5.74E-02
Silver	2.06E+00	2.70E-04	(11)	1.00E+00	(6)	2.32E-01
Thallium	6.38E-01	4.00E-03	(11)	1.00E+00	(6)	7.18E-02

(1) SP: soil-to-plant uptake factor.

(2) BAF: bioaccumulation factor.

(3) Deer mouse exposure calculated as

ED = [(Cs * SP * CF * Ip) + (Cs * BAF * Ia) + (Cs * Is)] * UFF / BW

Where, ED = exposure dose

Cs = RME conc in soil (mg/kg)

CF = plant dry-to-wet-weight conversion factor (0.2) (inorganics only)

SP = soil-to-plant uptake factor

Ip = plant-matter intake rate (0.00216 kg/day)

BAF = bioaccumulation factor (unitless)

Ia = animal-matter intake rate (0.00216 kg/day)

Is = incidental soil intake rate (0.000088 kg/day)

SFF = Site foraging factor (1)

BW = body weight (0.02 kg)

(4) Source: Baes et al., 1984.

(5) Source: Travis and Arms, 1988.

(6) Default where no experimental data available, no evidence of bioaccumulation.

(7) Source: Ma et al., 1983. Cu BAF based on soil conc.

(8) Source: Ma et al., 1983. Pb BAF is based on soil conc., pH (=7.5), and % organic matter (=3.68%).

(9) Source: Menzie et al., 1992.

(11) Source: NRC 1992.

(12) Source: EPA, 1994c.

(14) Source: Beyer and Cromartie, 1987. BAF based on highest level of earthworm uptake at industrial sites.

TABLE 7-18

CALCULATED SOIL RECEPTOR EXPOSURE
SUBSURFACE SOIL

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Constituent	RME Concentration (mg/kg)	SP[1]	BAF[2]	Deer Mouse Exposure (mg/kg/day) [3]
Semivolatiles				
Dibenzofuran	3.60E-02	1.72E-01 (5)	1.00E+00 (6)	4.72E-03
Pesticides				
Endrin ketone	2.73E-03	2.20E-02 (5)	2.50E-01 (4)	9.22E-05
Herbicides				
MCPA	6.26E+00	1.00E+00 (6)	1.00E+00 (6)	1.38E+00
Metals				
Antimony	9.89E+00	1.30E-04 (11)	1.00E+00 (6)	1.11E+00
Arsenic	6.21E+00	4.00E-02 (11)	1.00E+00 (6)	7.03E-01
Barium	1.53E+02	1.50E-01 (11)	1.00E+00 (6)	1.77E+01
Copper	1.76E+02	4.00E-01 (11)	4.29E-01 (8)	1.04E+01
Lead	2.46E+03	5.80E-03 (11)	3.45E-01 (8)	1.03E+02
Mercury	1.15E-01	9.00E-01 (11)	2.30E+01 (12)	2.88E-01
Selenium	6.98E-01	2.50E-02 (11)	4.70E-01 (13)	3.89E-02
Silver	1.65E+00	4.00E-03 (11)	1.00E+00 (6)	1.86E-01

(1) SP: soil-to-plant uptake factor.

(2) BAF: bioaccumulation factor.

(3) Deer mouse exposure calculated as

ED = [(Cs * SP * CF * Ip) + (Cs * BAF * Ia) + (Cs * Is)] * UFF / BW

Where, ED = exposure dose

Cs = RME conc in soil (mg/kg)

CF = plant dry-to-wet-weight conversion factor (0.2) (inorganics only)

SP = soil-to-plant uptake factor

Ip = plant-matter intake rate (0.00216 kg/day)

BAF = bioaccumulation factor (unitless)

Ia = animal-matter intake rate (0.00216 kg/day)

Is = incidental soil intake rate (0.000088 kg/day)

SFF = Site foraging factor (1)

BW = body weight (0.02 kg)

(4) Source: Menzie et al., 1992.

(5) Source: Travis and Arms, 1988.

(6) Default where no experimental data available, no evidence of bioaccumulation.

(7) Source: Marquenie et al., 1987 from Beyer, 1990.

(8) Source: Ma et al,. 1983. Pb BAF is based on soil conc., pH (=7.5), and % organic matter (=3.68%).

(9) Substituted value for benzo(a)pyrene.

(10) Source: Ash and Lee, 1980.

(11) Source: NRC, 1992.

(12) Source: EPA, 1994c.

(13) Source: Beyer and Cromartie, 1987. BAF based on highest level of earthworm uptake at industrial sites.

A site foraging factor (SFF) is calculated to account for the reasonably-expected use of an exposure group. Because of the small area of their home ranges and their year-round residence, mice and other small mammals living on the site could potentially use contaminated areas 100 percent of the time. The exposure dose calculations assumed the mouse would be exposed to the contaminants at the site in proportion to the size of the site (2.8 acres) compared to the typical size of an deer mouse foraging area (0.15 acre). Therefore, an SFF of 1 was used.

Table 7-17 and 7-18 show the soil-to-plant uptake factors, bioaccumulation factors, and the calculation of daily intakes for soil and biota.

For the aquatic receptor, the creek chub, intake rates were not calculated, as risk was characterized by comparing concentrations of contaminants in surface water and sediment with published toxicity concentrations in water and sediment. This is appropriate, as the toxicity values assume exposure by ingestion and absorption.

7.6.3.4 Effects Assessment

The effects assessment defines and evaluates the potential ecological response to ecological COPCs in terms of the selected assessment and measurement endpoints. The effects assessment includes the derivation of toxicity reference values (TRVs) that are the basis of the comparison. Section 7.6.4 uses the results of the toxicity assessment to identify ecological COCs and characterize ecological risk.

The methodology for assessing the potentially toxic effects of COPCs was based on the derivation of a TRV for each COPC in soil, surface water, and sediment. The TRVs were derived to represent reasonable estimates of the constituent concentrations that, if exceeded in an environmental medium, may produce toxicity effects in ecological receptors exposed to that medium. Ideally, TRV values would be based on site-specific toxicity data. However, in the absence of site-specific data, toxicity data from the literature were used by establishing data selection criteria such that TRVs would be as relevant as possible to assessment endpoints at SEAD-17. Furthermore, the conservativeness of the TRVs was reinforced by using the lowest available, appropriate toxicity values and modifying them by uncertainty factors when necessary. The derivation of TRVs is shown in Tables 7-19 for soil, 7-20 for surface water, and 7-21 for sediment.

The toxicity benchmarks used as effects thresholds for the evaluation of the assessment endpoint (maintenance of healthy populations of small mammals and fish) are based on LOAELs for test organisms (Sample et al., 1996). These are predicted to translate into less than 20 percent

TABLE 7-19

TOXICITY REFERENCE VALUES FOR ECOLOGICAL COPCs
SURFACE AND SUBSURFACE SOIL

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Constituent	Test Organism	Endpoint/Duration/Effect	Source	Effect Dose (mg/kg/day)	Surrogate Chemical UF[1]	Endpoint UF[1]	Study Duration UF[1]	Inter-taxon UF[1]	Total UF[1]	Toxicity Reference Value[2] (mg/kg/day)
Semivolatile Organics										
Dibenzofuran		no data								no data
Pesticides										
Endrin ketone	mouse	LOAEL, diet, 120-day, reproduction (Endrin)	Sample et al 1996	9.20E-01	10	1	1	5	50	1.84E-02
Herbicides										
MCPA	rat	LEL, diet, 90-day, increased kidney weight	EPA (IRIS), 1996b	7.60E+00	1	1	5	5	25	3.04E-01
Metals										
Antimony	mouse	LOAEL, water, lifetime, reduced lifespan	Sample et al 1996	1.25E+00	1	1	1	5	5	2.50E-01
Arsenic	mouse	LOAEL, gavage, 19-day, reduced fertility	ATSDR, 1991a	5.50E+01	1	1	10	5	50	1.10E+00
Barium	rat	LOAEL, water, 10 days, mortality	Sample et al 1996	1.98E+02	1	3	10	5	150	1.32E+00
Copper	mouse	LOAEL, diet, 13-wk, gastrointestinal effects	ATSDR, 1990b	1.55E+02	1	1	5	5	25	6.20E+00
Lead	rat	LOAEL, oral, 3 generations, reproductive effects	Sample et al 1996	8.00E+01	1	1	1	5	5	1.60E+01
Mercury	rat	LOAEL, diet, 3 generations, reproductive effects	Sample et al 1996	1.60E-01	1	1	1	5	5	3.20E-02
Selenium	mouse	LOAEL, water, 3 generations, reproductive effects	Sample et al 1996	7.50E-01	1	1	1	5	5	1.50E-01
Silver	mouse	LOAEL, water, 125-day, neurological effects	ATSDR, 1990c	1.81E+01	1	1	5	5	25	7.24E-01
Thallium	rat	LOAEL, water, 60-day, reproductive effects	ATSDR 1990d	7.40E-01	1	1	5	5	25	2.96E-02

[1] UF = uncertainty factor. Uncertainty factors are based on an EPA Region VIII method as described in Section 7.6.3.4.

[2] The toxicity reference value was derived by dividing the effect dose by the total uncertainty factor.

TABLE 7-20

TOXICITY REFERENCE VALUES FOR ECOLOGICAL COPCs
SURFACE WATER

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Constituent	Endpoint	Source	Surrogate UF[1]	Toxicity Reference Value[2] (ug/L)
Semivolatile Organics				
bis(2-Ethylhexyl)phthalate	Lowest EC20, fish	Suter & Tsao, 1996	1	5.40E+01
Metals				
Barium	EC16, Daphnia magna	Suter & Tsao, 1996	1	5.80E+03
Copper	Lowest EC20, fish	Suter & Tsao, 1996	1	5.00E+00
Iron	Lowest EC20, daphnids	Suter & Tsao, 1996	1	1.60E+01
Lead	Lowest EC20, fish	Suter & Tsao, 1996	1	2.20E+01
Selenium	Lowest EC20, fish	Suter & Tsao, 1996	1	4.00E+01

[1] UF = uncertainty factor.

[2] The toxicity reference value was derived by dividing the reported concentration by the surrogate uncertainty factor.

TABLE 7-21

TOXICITY REFERENCE VALUES FOR ECOLOGICAL COPCs
SEDIMENT

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Constituent	Endpoint	Source	Surrogate UF[1]	Toxicity Reference Value[2] (mg/kg)
Volatile Organics				
Acetone	Lowest chronic value, fish	Jones et al., 1996	1	3.65E+00
Semivolatile Organics				
2,4-Dimethylphenol	Lowest chronic value, fish (2-methylphenol)	Jones et al., 1996	10	5.47E-02
2,4-Dinitrotoluene	no data			
Pesticides				
4,4'-DDD	Lowest chronic value, fish	Jones et al., 1996	1	2.08E+01
4,4'-DDE	Lowest chronic value, fish	Jones et al., 1996	10	2.08E+00
Endosulfan I	Benthic aquatic life chronic toxicity	NYSDEC, 1993b	1	3.69E-04
Endosulfan II	Benthic aquatic life chronic toxicity	NYSDEC, 1993b	1	3.69E-04
Metals				
Aluminum	None available		1	none avail
Antimony	Lowest effect level	NYSDEC, 1993b	1	2.00E+00
Arsenic	Lowest effect level	NYSDEC, 1993b	1	6.00E+00
Barium	None available		1	none avail
Beryllium	None available			none avail
Cadmium	Lowest effect level	NYSDEC, 1993b	1	6.00E-01
Chromium	Lowest effect level	NYSDEC, 1993b	1	2.60E+01
Cobalt	None avail		1	none avail
Copper	Lowest effect level	NYSDEC, 1993b	1	1.60E+01
Iron	Lowest effect level	NYSDEC, 1993b	1	2.00E+04
Lead	Lowest effect level	NYSDEC, 1993b	1	3.10E+01
Manganese	Lowest effect level	NYSDEC, 1993b	1	4.60E+02
Mercury	Lowest effect level	NYSDEC, 1993b	1	1.50E-01
Nickel	Lowest effect level	NYSDEC, 1993b	1	1.60E+01
Selenium	None avail		1	none avail
Thallium	None avail		1	none avail
Vanadium	None avail		1	none avail
Zinc	Lowest effect level	NYSDEC, 1993b	1	1.20E+02

[1] UF = uncertainty factor. Uncertainty factors are based on an EPA Region VIII method as described in Section 7.6.3.4.

[2] The toxicity reference value was derived by dividing the effect dose by the total uncertainty factor. TRVs taken from Jones et al. (1996) are based on % organic carbon for SEAD-17 sediment samples (=1.23%).

reduction in population size (Suter et al., 1994) or Lowest Observed Effects Concentrations. LOAELs are appropriate for evaluating the risk to non-threatened and endangered receptor populations (Suter et al., 1994).

For the terrestrial receptor, the order of taxonomic preference when choosing TRVs was data from studies using (1) native small mammal species potentially present at the site, or (2) proxy species, such as commonly studied laboratory species. The preferred toxicity test endpoint was the lowest appropriate chronic LOAEL for non-lethal or reproductive effects. LOAELs are appropriate for evaluating the risk to non-threatened/endangered receptor populations (Suter et al., 1994). When values were not available for these effects, LOAELs for lethal toxic effects or NOAELs were used, as available. Values based on chronic studies were preferred. Studies were considered to provide chronic toxicity data if conducted for a minimum duration of 1 year in mammals. Studies longer than acute but shorter than chronic are considered subchronic. Studies shorter than 90 days in mammals were considered acute. Studies on developmental effects were considered chronic if conducted during a critical gestation period. If LOAEL data were not available for a constituent, the next preferred form of toxicity data for use in deriving a TRV was an LD_{50} (median lethal dose), or an LC_{50} (median lethal concentration).

The toxicity values selected by this approach were modified through the application of uncertainty factors, as applicable, to derive a TRV for each COPC. The TRVs represent LOAELs with uncertainty factors incorporated for toxicity information derived from studies other than chronic lowest-effects studies and studies on species other than the receptors selected for this risk assessment. EPA Region VIII (EPA, 1994a) has identified major areas where receptors differ in response to constituent exposure, as follows: type of study endpoint (e.g., chronic LOAEL versus acute LD_{50}), study duration (acute versus chronic), and species used for toxicity test. Each of these areas is then assigned an uncertainty factor from 1 to 20 based on the inherent variance. In addition, where toxicity information for a surrogate contaminant was used, an additional uncertainty factor of 10 was applied. Uncertainty factors were applied by dividing the initial toxicity value by the product of the necessary uncertainty factors. Uncertainty factors are listed in Table 7-22 and applied to TRVs in Table 7-19 for soil COPCs.

For surface water, the lowest concentration having an adverse effect on 20 percent of the test fish population (EC_{20}), as reported by Suter and Tsao (1996), was selected as the TRV. This represents a LOAEL-type endpoint for a fish population. Where no fish toxicity levels were reported, the lowest chronic aquatic invertebrate toxicity test result, as reported by Suter and Tsao (1996), was used for comparison purposes.

TABLE 7-22

ECOLOGICAL UNCERTAINTY FACTORS USED IN DERIVATION OF TRVs

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Category of Uncertainty	Uncertainty Value[1]	
Surrogate constituent		
Use of surrogate constituent	10	
Intertaxon Extrapolation		
Same species	1	
Same genus, different species	3	
Same family, different genus	5	
Same order, different family	7	
Same class, different order	10	
Study Duration Extrapolation		
Chronic studies, equilibrium attained	1	
Subchronic studies	5	
Acute studies	10	
Single dose	20	
Unknown	20	
Endpoint Extrapolation	**Nonlethal**	**Lethal**
No observed effects level	1	1
No observed advese effects level	1	1
Lowest observed effects level	1	3
Lowest observed adverse effects level	1	3
Effect concentration to 50% of test organisms	10	15
Unknown	10	15

Source: EPA, 1994a.

[1] The product of the appropriate uncertainty value from each uncertainty category becomes the uncertainty factor applied to develop the constituent-specific TRV.

For sediment, the exposure point concentrations (RMEs) of organic COPCs were compared to lowest chronic toxicity values for fish, as developed by Jones et al. (1996) using an equilibrium partitioning approach. This approach assumes that pore water concentrations of organics are representative of concentrations to which receptors would be exposed, and pore water concentrations are calculated from sediment concentrations using equilibrium partitioning based on octanol/water partitioning coefficients and the organic carbon content of the sediment.

Partitioning of metals from sediment to pore water is dependent on a number of factors. Without additional information, pore water concentrations of the metals in the SEAD-17 ditches cannot be calculated. Consequently, the sediment RME concentrations were compared directly to the NYSDEC (1993b) screening criteria.

7.6.4 Risk Characterization

Risk characterization integrates exposure(s) and effect(s) on receptors using hazard quotients (HQs) (ratios of exposure and effect concentrations). The resulting data are used to define the magnitude of risk from ecological COPCs at the site and to assess the risk to ecological receptors. Risk characterization includes two main steps: risk estimation and risk description. Risk estimation (Section 7.6.4.1) uses the results of the exposure and effects assessments to calculate an HQ for each COPC. The HQs are based on relevant measurement endpoints and are indicative of the COPC's potential to pose ecological risk to receptors. Risk assessment related uncertainties are also analyzed and discussed. Risk description (Section 7.6.4.2) summarizes the conclusions of the risk estimation and discusses confidence in the risk estimates based on a weight-of-evidence evaluation. Any COPCs for a given exposure group and medium that were identified as likely to pose significant risk to receptors were classified as ecological chemicals of concern (COCs).

7.6.4.1 Risk Estimation

Estimation of a COPC's potential to pose significant risk to receptors is based on the magnitude of the HQ value calculated for each constituent, as well as other factors such as the bioaccumulation/biomagnification potential, mechanism of toxicity, physicochemical characteristics, environmental fate, and ecological relevance of each contaminant. Tables 7-23 through 7-26 present the calculation of HQs for COPCs. An HQ is a ratio of the estimated exposure dose (for terrestrial receptors) or concentration (for aquatic receptors) of a constituent to the TRV. Generally, the greater this ratio or quotient, the greater the likelihood of an effect. A quotient of 1 is considered the threshold level at which effects may occur. The TRVs on

TABLE 7-23

CALCULATION OF SOIL HAZARD QUOTIENTS
SURFACE SOIL

SEAD-17 Remedial Investigation
Seneca Army Depot

Constituent	Deer Mouse Exposure (mg/kg/day) [1]	Toxicity Reference Value (mg/kg/day) [2]	Hazard Quotient [3]
Semivolatile Organics			
Dibenzofuran	4.72E-03	no data	--
Pesticides			
Endrin ketone	9.90E-05	1.84E-02	5.4E-03
Herbicides			
MCPA	1.87E+00	2.50E+01	7.5E-02
Metals			
Arsenic	7.29E-01	1.10E+00	6.6E-01
Barium	1.93E+01	1.32E+00	**1.5E+01**
Copper	1.27E+01	6.20E+00	**2.0E+00**
Lead	9.32E+01	1.60E+01	**5.8E+00**
Mercury	3.29E-01	3.20E-02	**1.0E+01**
Selenium	5.74E-02	1.50E-01	3.8E-01
Silver	2.32E-01	7.24E-01	3.2E-01
Thallium	7.18E-02	2.96E-02	**2.4E+00**

(1) Receptor exposure from Table 7-17
(2) Toxicity reference value from Table 7-19
(3) Hazard quotient calculated as HQ = exposure rate / toxicity reference value
with HQ < 1, no effects expected
1 < HQ =< 10, small potential for effects
10 < HQ =< 100, potential for greater exposure to result in effects, and
HQ > 100, highest potential for effects.
BOLD : represents receptor HQ >= 1.
-- : no HQ could be calculated, as no toxicity data could be found.

TABLE 7-24

CALCULATION OF SURFACE WATER HAZARD QUOTIENTS

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Constituent	RME Concentration (ug/L)[1]	Toxicity Reference Value (ug/L)[2]	Hazard Quotient[3]
Semivolatile Organics			
bis(2-Ethylhexyl)phthalate	2.00E+00	5.40E+01	3.7E-02
Metals			
Barium	7.20E+00	5.80E+03	1.2E-03
Copper	1.93E+01	5.00E+00	**3.9E+00**
Iron	1.93E+01	1.60E+01	**1.2E+00**
Lead	3.71E+01	2.20E+01	**1.7E+00**
Selenium	3.23E+00	4.00E+01	8.1E-02

(1) RME concentration from Table 7-15
(2) Toxicity reference value from Table 7-20
(3) Hazard quotient calculated as HQ = exposure rate / toxicity reference value
with HQ < 1, no effects expected
1 < HQ =< 10, small potential for effects
10 < HQ =< 100, potential for greater exposure to result in effects, and
HQ > 100, highest potential for effects.
BOLD : represents receptor HQ >= 1.
-- : no HQ could be calculated, as no toxicity data could be found.

TABLE 7-25

CALCULATION OF SEDIMENT HAZARD QUOTIENTS

SEAD-17 Remedial Investigation
Seneca Army Depot Activity

Constituent	RME Concentration (mg/kg)[1]	Toxicity Reference Value (mg/kg)[2]	Hazard Quotient[3]
Volatile Organics			
Acetone	1.44E-02	3.65E+00	3.9E-03
Semivolatile Organics			
2,4-Dimethylphenol	3.20E-02	5.47E-02	5.9E-01
2,4-Dinitrotoluene	3.14E-01	none avail	--
Pesticides			
4,4'-DDD	6.46E-03	2.08E+01	3.1E-04
4,4'-DDE	4.82E-02	2.08E+00	2.3E-02
Endosulfan I	1.43E-03	3.69E-04	**3.9E+00**
Endosulfan II	3.05E-03	3.69E-04	**8.3E+00**
Metals			
Aluminum	1.83E+04	none avail	--
Antimony	5.50E+00	2.00E+00	**2.8E+00**
Arsenic	6.10E+00	6.00E+00	**1.0E+00**
Barium	1.32E+02	none avail	--
Beryllium	7.64E-01	none avail	--
Cadmium	2.40E+00	6.00E-01	**4.0E+00**
Chromium	2.47E+01	2.60E+01	9.5E-01
Cobalt	1.26E+01	none avail	--
Copper	1.33E+02	1.60E+01	**8.3E+00**
Iron	2.94E+04	2.00E+04	**1.5E+00**
Lead	6.83E+02	3.10E+01	**2.2E+01**
Manganese	5.32E+02	4.60E+02	**1.2E+00**
Mercury	8.11E-02	1.50E-01	5.4E-01
Nickel	3.16E+01	1.60E+01	**2.0E+00**
Selenium	1.27E+00	none avail	--
Thallium	8.24E-01	none avail	--
Vanadium	2.97E+01	none avail	--
Zinc	1.88E+02	1.20E+02	**1.6E+00**

(1) RME concentration from Table 7-15

(2) Toxicity reference value from Table 7-21

(3) Hazard quotient calculated as HQ = exposure rate / toxicity reference value
with HQ < 1, no effects expected
1 < HQ =< 10, small potential for effects
10 < HQ =< 100, potential for greater exposure to result in effects, and
HQ > 100, highest potential for effects.

BOLD : represents receptor HQ >= 1.

-- : no HQ could be calculated, as no toxicity data could be found.

TABLE 7-26

CALCULATION OF SOIL HAZARD QUOTIENTS
SUBSURFACE SOIL

SEAD-17 Remedial Investigation
Seneca Army Depot

Constituent	Deer Mouse Exposure (mg/kg/day)[1]	Toxicity Reference Value (mg/kg/day)[2]	Hazard Quotient[3]
Semivolatile Organics			
Dibenzofuran	4.72E-03	no data	--
Pesticides			
Endrin ketone	9.22E-05	1.84E-02	5.0E-03
Herbicides			
MCPA	1.38E+00	2.50E+01	5.5E-02
Metals			
Antimony	1.11E+00	2.50E-01	**4.4E+00**
Arsenic	7.03E-01	1.10E+00	6.4E-01
Barium	1.77E+01	1.32E+00	**1.3E+01**
Copper	1.04E+01	6.20E+00	**1.7E+00**
Lead	1.03E+02	1.60E+01	**6.4E+00**
Mercury	2.88E-01	3.20E-02	**9.0E+00**
Selenium	3.89E-02	1.50E-01	2.6E-01
Silver	1.86E-01	7.24E-01	2.6E-01

(1) Receptor exposure from Table 7-18

(2) Toxicity reference value from Table 7-19

(3) Hazard quotient calculated as HQ = exposure rate / toxicity reference value
with HQ < 1, no effects expected
1 < HQ =< 10, small potential for effects
10 < HQ =< 100, potential for greater exposure to result in effects, and
HQ > 100, highest potential for effects.

BOLD : represents receptor HQ >= 1.

-- : no HQ could be calculated, as no toxicity data could be found.

which the HQs were based were derived to be conservative and representative of chronic exposures, as described previously in Section 7.6.3.4.

The calculated HQs were used to assess the potential that toxicological effects will occur among the site's receptors. The HQs were compared to HQ guidelines for assessing the risk posed from contaminants (Menzie et al., 1993). These guidelines suggest that HQs less than or equal to 1 present no probable risk; HQs from 1 up to, but less than, 10 present a small potential for environmental effects; HQs from 10 up to, but less than 100 present a significant potential for ecological effects, and HQs greater than 100 present the highest potential for expected effects. The likelihood that a population of deer mice could be significantly impacted by the toxicological effect(s) produced by a given COPC was a major factor in the subsequent determination (in Section 7.6.4.2) of whether that contaminant should be classified as an ecological COC.

Ecological risk from COPCs was characterized for both current and potential future land use conditions at the site (Sections 7.6.4.1.1 and 7.6.4.1.2, respectively). Under current conditions, ecological receptors are unlikely to be exposed to soils deeper than 0.5 foot. Therefore, soil data from the surface down to this depth were used in characterizing current risk at SEAD-17. Under hypothetical future land uses involving construction, deeper (subsurface) soils could be excavated and distributed on the surface, where ecological receptors might then be exposed. Therefore, soil data from the surface down to a depth of 4 feet were used in characterizing risk associated with the KBRP under future conditions. Current and future conditions were assumed to be the same for the drainage ditches (surface water and sediment). Consequently, the drainage ditches are discussed only under current land use.

7.6.4.1.1 Current Land Use

Soil (0 - 0.5 ft)

For soil sampled to a depth of 0.5 ft at SEAD-17, HQs calculated for the COPCs equaled or exceeded a value of 1 for barium (HQ = 15), copper (HQ = 2), lead (HQ = 5.8), mercury (HQ = 10), and thallium (HQ = 2.4) (Table 7-23). Dibenzofuran was carried through as a COPC because no toxicity data were available to calculate a TRV.

The HQ for barium (HQ = 15) was greater than 10. However, the toxicity benchmark value was based on an acute study in which barium was administered to rats in drinking water. When ingested by animals, soluble barium compounds are absorbed to a limited extent, while insoluble forms, such as barium sulfate and barium carbonate, are only minimally absorbed. Thus, soluble forms are highly toxic relative to insoluble forms (ATSDR, 1990a), and barium that has not leached from surficial soils at the site is likely to be in an insoluble form. Therefore, the study animals ingested soluble, more toxic forms of barium in water, while receptors at the unit would likely ingest insoluble, less toxic forms in soil. Based on these factors, barium in soil from this location was estimated to pose essentially no risk to assessment endpoints and is not considered to be a COC.

The HQ for copper (HQ = 2) marginally exceeded 1. The TRV is based on a subacute (13-week) dietary study in which gastrointestinal effects were observed in mice. It is not known what result such effects, if experienced by the deer mice at the site, would have on the deer mouse population. Given the low HQ, copper is not considered to be a COC in surface soil at the site.

The HQ for lead (HQ = 5.8) exceeded 1 but did not exceed 10. Oral exposure to lead leads to increases in blood pressure in laboratory animals (lead-induced hypertension) as well as interference with heme synthesis. Lead can also affect reproductive success in small mammals. A LOAEL resulting in reduced offspring weights and kidney damage in the young in a 3-generation reproductive test in laboratory rats was used to generate the TRV for this assessment (Sample et al. 1996). It is not known if such an effect would have an effect on the populations of small mammals at the site. For this reason and because of the HQ less than 10, lead is not considered a COC at this site.

Mercury has an HQ (HQ = 10) equal to 10. Mercury and its compounds have no known biological function. Mercury toxicity in aquatic and terrestrial organisms is well documented. The kidney as well as the central nervous system is the probable critical organ for toxicity effects from mercury in mammals. Mercury also causes teratogenic, mutagenic, and carcinogenic effects. Organic forms of mercury are capable of biomagnifying, especially in aquatic systems. In terrestrial food chains, little is known of mercury bioaccumulation. Carnivores at the top of the food chain appear to have elevated mercury concentrations, indicating biomagnification. The form(s) of mercury composing the total mercury concentration at the site is not known, so a conservative toxicity level from a chronic study on methyl mercury, an organic form of the metal, was used for the TRV (Sample et al. 1996). It is unlikely that all or most of the soil mercury is in the organic form, as organic mercury tends to be found more commonly in anaerobic sediments. Inorganic forms of mercury are generally less toxic than organic forms. Nothing is known of the bioavailability of the mercury in soil at the site either. Absorption of inorganic mercury from oral exposure has been reported at 2 to 38 percent (ATSDR, 1994e). For these reasons, mercury in soil was not judged to present a significant potential for adverse effects and is not considered a COC.

The HQ for thallium (HQ = 2.4) exceeded 1. While it appears that thallium may be completely absorbed from the gastrointestinal tract by animals consuming it in pure form, no information was available on bioavailability of thallium from a soil medium. The TRV is based on a subchronic study in which thallium was administered to rats in water. Likewise, no information was available on bioaccumulation of thallium in the terrestrial food chain, except for soil-to-plant uptake. Thallium does appear to bioaccumulate in an aquatic food chain. Given this uncertainty and the low HQ, thallium is not considered a COC for surface soil at this unit.

Dibenzofuran also lacked data by which to evaluate its toxicity. Bioconcentration studies have shown that dibenzofuran can bioaccumulate significantly in aquatic organisms, but that depuration is rapid (HSDB, 1994). Therefore, long-term bioaccumulative effects and biomagnification are unlikely, and this compound is estimated to pose minimal ecological risk and is not considered to be a COC.

Surface Water

Of the HQs calculated for the COPCs detected in surface water at SEAD-17, the HQs for copper (HQ = 3.9), iron (HQ =1.2), and lead (HQ = 1.7) exceeded a value of 1 (Table 7-24).

The HQ for copper (HQ = 3.9) exceeded 1, but was below 10. The TRV used to calculate the HQ was based on an early life stage test with brook trout (Suter and Tsao, 1996), which may not represent the warm water fish populations present in the SEAD-17 ditches. The New York Ambient Water Quality Standard for copper for Class C water is 20 ug/L, at a hardness value of 188.18 mg/L CaCO3. This is higher than the RME copper concentration of 19.3 ug/L. For these reasons, copper is not considered a COC in SEAD-17 surface water.

The HQ for iron (HQ=1.2) exceeded 1, but was below 10. As with copper, the TRV used to calculate the HQ was based on an embryo-larval test with rainbow trout, a sensitive species that may not be representative of the fish species inhabiting the site ditches. The New York Ambient Water Quality Standard for iron for Class C water is 300 ug/L, at a hardness value of 188.18 mg/L CaCO3. This is higher than the RME iron concentration of 237 ug/L. For these reasons, iron is not considered a COC in SEAD-17 surface water.

The HQ for lead (HQ = 1.7) is greater than 1, but well below 10. The RME concentration for lead in surface water, 37.1 ug/L, is 5 times greater than the New York Ambient Water Quality Standard for lead for Class C water (considering hardness), which is 7.2 ug/L. Lead was detected in 6 of 10 surface water samples, and the RME concentration is the same as the maximum concentration. The central tendency exposure point concentration of 2.82 ug/L is considerably lower than the RME, and also lower than the Ambient Water Quality Standard and the TRV. Considering the poor habitat and the flow variability of the ditches at the site, it is unlikely that the fish observed in the ditches spend long periods of time in one location in a site ditch. Instead, the fish are more likely to move into the ditches when flow is available and downstream when the flow decreases. Downstream areas also provide better physical habitat for egg and larval development. For these reasons, lead is not considered to be a COC in the site surface water.

Sediment

Of the HQs calculated for the COPCs detected in sediment at SEAD-17, the HQs for endosulfan I (HQ = 3.9), endosulfan II (HQ = 8.3), antimony (HQ = 2.8), arsenic (HQ = 1.0), cadmium (HQ = 4.0), copper (HQ = 8.3), iron (HQ = 1.5), lead (HQ = 22), manganese (HQ = 1.2), nickel (HQ = 2.0), and zinc (HQ = 1.6) exceeded a value of 1 (Table 7-25). No toxicity values could be found for 2,4-dinitrotoluene, aluminum, barium, beryllium, cobalt, selenium, thallium, and vanadium.

The concentrations of metals and endosulfan I and II in sediment were compared to NYSDEC screening criteria, which do not account for bioavailability. The screening criteria also were developed with the assumption that the aquatic organisms would be exposed to the contaminants during the entire year. As flow is variable in the site ditches and they do not provide quality habitat, it is unlikely that the receptors are exposed all year. Additional testing would provide more information on bioavailability and toxicity of the site sediment. Without this information, it cannot be determined with confidence that the sediment is not causing adverse effects to assessment endpoints. However, given the low HQs and the very conservative screening criteria that were used for TRVs, it is unlikely that the sediment contaminants are COCs.

7.6.4.1.2 Future Land Use

Soil (0 - 4 ft)

Of the HQs calculated for the COPCs detected in soil to a depth of 4 ft at SEAD-17, the HQs for antimony (HQ = 4.4), barium (HQ = 13), copper (HQ = 1.7), lead (HQ = 6.4), and mercury (HQ = 9.0) (Table 7-26) exceeded 1. As for the soil at a depth of 0 - 0.5 ft, barium, copper, lead, and mercury were not considered to be COCs at a depth of 0 - 4 ft.

The HQ for antimony (HQ = 4.4) exceeded 1, but did not exceed 10. The TRV for antimony was based on a chronic study in which the median lifespan was reduced among female laboratory mice after exposure to antimony potassium tartrate in drinking water. This form of antimony tends to strongly adsorb to most soils (ATSDR, 1992b) and may not be highly bioavailable under natural conditions. However, lacking site-specific data, bioavailability was assumed to be 100 percent, which is likely to overestimate bioavailability. An animal bioaccumulation factor could not be found for antimony, but it does not appear to appreciably bioaccumulate (ATSDR, 1992b). Without more specific information, however, an animal bioaccumulation factor of 1 was used, which is likely to overestimate bioaccumulation. for these reasons, antimony is not considered to be a COC in subsurface soil at the site.

As with the 0 - 0.5 ft soil, dibenzofuran was carried through as a COPC because toxicity data were not available to calculate a TRV. For reasons discussed under current soil conditions, this constituent is not considered to be a COC.

7.6.4.2 **Uncertainty**

Uncertainty is inherent in each step of the ecological risk assessment process. Major factors contributing to uncertainty in this risk assessment are discussed qualitatively in the following sections.

7.6.4.2.1 Chemicals of Potential Concern

The sampling data may not represent the actual overall distribution of contamination at the site, which could result in underestimation or overestimation of potential risk from identified chemicals. However, the use of RME concentrations provided conservative exposure estimates and it is, therefore, unlikely that the potential for deleterious levels of contaminants has been underestimated.

7.6.4.2.2 Exposure Assessment

While the potential receptor species selected for the site are inevitably a limited subset of the total list of species that may utilize the site, the potential exposure of the species evaluated in this assessment is considered likely to be representative of the nature and magnitude of the exposures experienced by those species not discussed.

Risk associated with intake of contaminants through the terrestrial food chain was addressed by modeling food chain transfer of chemical residues through plants and earthworms. The degree of uncertainty in the results of the analysis increases with the increasing distance of the receptor from the base of the food chain. Intakes from dermal contact with and inhalation of contaminants were not quantifiable for ecological receptors. However, this does not significantly increase the uncertainty of the estimated intakes because for most receptors, intakes via these routes are likely to be minimal relative to intakes via ingestion.

Risk was estimated for both current land use and future land use conditions. Whereas estimates of the potential for risk to assessment endpoints under current conditions potentially could be underestimated because of data insufficiencies (although unlikely because of conservative assumptions), such estimates for hypothetical future conditions are more likely to overestimate the potential for adverse effects.

7.6.4.2.3 Toxicity Assessment

There is uncertainty associated with the TRVs calculated for this risk characterization because the toxicity data were not site-specific. However, the TRVs used were conservative and were modified by uncertainty factors where necessary to increase the applicability of the data to the assessment. The HQs calculated from these conservative TRVs and RME concentrations provide confidence that the risk assessment yielded reasonably conservative estimates of the potential risk of adverse ecological effects on the assessment endpoint.

Each COPC was assumed to be highly bioavailable. However, for most chemicals in most media, this is an overestimation (Dixon et al., 1993) that may result in an overestimation of the potential for ecological risk. Empirical information on bioavailability of the COPCs was not available. No leachability tests in soil were conducted. It is possible that some of the contaminants, particularly the metals, may be bound to soil particles and not available for uptake by receptors. This would tend to overestimate risk.

The soil-to-plant uptake equations and the BAFs include a bioavailability factor; however, these data, taken from the scientific literature, are not specific to this site and may under- or overestimate exposure. For several metals, no quantitative bioavailability data could be found, other than an indication from the literature that the constituent does not significantly bioaccumulate. For these metals, a bioaccumulation factor of 1.0 was used in the exposure equation. This is likely to overestimate the actual value.

The potential for toxic effects to be produced in receptor organisms as a result of exposure to multiple chemicals in a single medium or in multiple media was not evaluated. Therefore, the potential toxic effects in a receptor as a result of exposure to a given medium could be higher or lower than estimated, depending on toxicological interactions. Exposure of a receptor to multiple contaminated media is likely to increase the risk of toxic effects.

7.6.4.2.4 Risk Characterization

The methodology, conservative assumptions, and toxicity benchmarks used in the risk estimation portion of the risk characterization are expected to overestimate, rather than underestimate, the potential for COPCs to pose risk to the ecological assessment endpoint. RME environmental concentrations were used, concentrations were assumed to remain constant over time, and the toxicity benchmarks used were the lowest reported LOAEL values for non-lethal or reproductive effects appropriate for extrapolation to effects on the assessment endpoint.

7.6.4.3 Risk Description

The risk description has two main elements: (1) the ecological risk summary, which summarizes the results of the risk estimation and uncertainty analysis and assesses confidence in the risk estimates based on weight of evidence and (2) the interpretation of ecological significance, which describes the magnitude of the identified risks to the assessment endpoint(s).

7.6.4.3.1 Ecological Risk Summary

The risk estimation step resulted in the identification of a subset of COPCs for each medium for both current and hypothetical future conditions. These subsets of COPCs include those contaminants estimated to have the potential to pose adverse effects to the assessment endpoints selected in Section 6.2.3. In the following section, these COPCs are further evaluated based on weight of evidence, and a determination is made as to whether any have a high likelihood of being a significant risk to the receptor population analyzed for this risk assessment or the ecological community that encompasses the study area.

A hierarchy of assessment endpoints was selected to assess both proximate and ultimate risks that might be associated with site-related chemicals. The proximate assessment endpoint was chosen to provide protection of the population levels of vertebrate species that utilize the area of SEAD-17 to a significant extent and that are important as indicators of potential effects on the health of the community. Deer mice represent terrestrial vertebrate populations at SEAD-17 and creek chub represent the aquatic community. Although toxic effects that reduce this assessment endpoint population or the populations they represent in the immediate vicinity of the site are significant to the populations themselves, they are not necessarily significant to the ultimate, more important, assessment endpoint: the community of species that occupies the area surrounding and including the site.

It is this ultimate assessment endpoint, maintenance of the health and diversity of the natural community in the area, that is the most important ecological component to be protected with regard to this site. Therefore, those COCs estimated to pose a potential for adverse effects to proximate assessment endpoints are subsequently evaluated with regard to the risk they may pose to the ultimate assessment endpoint.

The ecological setting of SEAD-17 is not unique or significant, as described in Section 7.6.2.2. There are no endangered, threatened, or special concern species in the vicinity that are likely to be dependent on or affected by the habitat at the site. The species that inhabit the site are not rare in the region and are not generally considered to be of special societal value. The area of the site is small, and the habitat it provides appears to be relatively low in diversity and productivity.

Six of the COPCs identified in soil, three in surface water, and 11 in sediment at SEAD-17 have an HQ equal to or greater than 1. These are listed below according to the medium in which they occurred.

MEDIUM	COPC
SOIL	
current conditions	barium (HQ=15), copper (HQ=2.0), lead (HQ=5.8), mercury (HQ=10), thallium (HQ = 2.4)
future conditions	antimony (HQ=4.4), barium (HQ=13), copper (HQ=1.7), lead (HQ=6.4), mercury (HQ=9.0)
SURFACE WATER	copper (HQ=3.9), iron (HQ=1.2), lead (HQ=1.7)
SEDIMENT	endosulfan I (HQ=3.9), endosulfan II (HQ=8.3), antimony (HQ=2.8), arsenic (HQ=1.0), cadmium (HQ=4.0), copper (HQ=8.3), iron (HQ=1.5), lead (HQ=22), manganese (HQ=1.2), nickel (HQ=2.0), zinc (HQ=1.6)

There is a low likelihood of risk to the proximate terrestrial assessment endpoint (i.e., deer mouse populations at the site) from the concentrations of antimony, barium, copper, lead, mercury, and thallium based on the following weight of evidence.

- The HQs for antimony, copper, lead, and thallium are less than 10. According to the guidelines originally proposed by Menzie et al. (1993), HQs from 1 up to, but less than, 10 present a small potential for environmental effects.

- Calculation of the TRVs and exposure rates for the constituents was a very conservative process. For barium, for example, a total uncertainty factor of 150 was used to equate the acute lethal LOAEL toxicity datum to a chronic non-lethal LOAEL.
- Nothing is known about the bioavailability of the constituents in soil at the site. They may be present in an insoluble form in the soil, which is not very bioavailable for uptake by receptors. Some constituents are likely to be tightly bound to organic matter in the soil and therefore not very bioavailable for uptake. The exposure assessment assumed 100 percent bioavailability from soil, which is likely to more conservatively estimate risk.
- Habitat quality of the site is poor. It is unlikely that the site provides an important habitat that would support a significant portion (at least 20 percent) of the deer mouse population in the local area.

Therefore, antimony, barium, copper, lead, mercury, and thallium in surface and subsurface soil are not considered to be COCs.

The COPCs in surface water and sediment that have HQs greater than 1 are also not likely to adversely impact populations of creek chub in the surface water bodies at the Depot. The site ditches are not quality habitat and have variable flow throughout the course of a year. It is unlikely that the creek chub observed in the ditches make up 20 percent of the local population or even occupy the ditches on the site throughout the year. With HQs of most of the surface water and sediment COPCs less than 10 and based on very conservative assumptions, none was considered to be a COC.

7.6.4.3.2 Interpretation of Ecological Significance

There is a low likelihood of risk to the deer mouse and creek chub individuals that may use the site as a result of COPC concentrations in soil, surface water, and sediment.

7.7 SUMMARY

The human health risk assessment was performed in accordance with the USEPA's Risk Assessment Guidance for Superfund (EPA,1989b). The human health risk assessment considered six potential exposure scenarios: a current site worker, a future industrial worker, a future construction worker, a future trespasser, and an adult worker and child at an on-site day care center. The results of the human health risk assessment show that only a future industrial worker or construction worker has the potential to be exposed to chemicals of concern at levels that are above those defined by the USEPA. The ecological risk assessment was performed following the guidance presented in the New York State *Division of Fish and Wildlife Impact*

Analysis for Inactive Hazardous Waste Sites (NYSDEC 1994), *the Framework for Ecological Risk Assessment* (EPA, 1992f), and the *Procedural Guidelines for Ecological Risk Assessment at U.S. Army Sites, Vol. 1* (Wentsel et al., 1994). The results of the ERA indicate that the COPCs identified at SEAD-17 are considered to pose a negligible risk to the ecosystem surrounding the site.

7.7.1 Human Health Risk Assessment

Human health risks were calculated for six exposure scenarios:

1) current on-site worker;
2) future industrial worker;
3) future on-site construction worker;
4) future trespasser;
5) future child attending an on-site day care center; and
6) future adult worker at the day care center.

Cancer risks for all current and future receptors are below or within the EPA target risk range. Non-cancer hazard index values calculated for all current and future receptors are also below the target value of 1.0.

The potential risks from exposure to lead in soil were assessed separately from other compounds. The results of the IEUBK model for lead indicate that children who would ingest soil at a future SEAD 17 day care center would have median blood lead levels less than the 10 ug/dL level of concern established by EPA and other public health agencies. Furthermore, the current average soil lead concentration is less than the USEPA guideline value of 1750 mg/kg for adult exposure.

7.7.2 Ecological Risk Summary

A hierarchy of assessment endpoints was selected to assess both proximate and ultimate risks that might be associated with site-related chemicals. Deer mice represent terrestrial vertebrate populations at SEAD-17 and creek chub represent the aquatic community. Compared to the proximate, the ultimate assessment endpoint—maintenance of the health and diversity of the natural community in the area—is the most important ecological component to be protected with regard to this site. Therefore, those COCs estimated to pose a potential for adverse effects to proximate assessment endpoints are subsequently evaluated with regard to the risk they may pose to the ultimate assessment endpoint.

The ecological setting of SEAD-17 is not unique or significant—there are no endangered, threatened, or special concern species in the vicinity that are likely to be dependent on or affected by the habitat at the site. The species that inhabit the site are not rare in the region and are not generally considered to be of special societal value. The area of the site is small, and the habitat it provides appears to be relatively low in diversity and productivity.

Of the COPCs at SEAD-17 having an HQ equal to or greater than 1, six were identified in soil, three in surface water, and 11 in sediment.

There is a low likelihood of risk to the proximate terrestrial assessment endpoint (i.e., deer mouse populations at the site) from the concentrations of COPCs found in soil. Therefore none of these compounds are considered to be COCs. The COPCs in surface water and sediment that have HQs greater than 1 are also not likely to adversely impact populations of creek chub in the surface water bodies at the Depot. The site ditches are not quality habitat and have variable flow throughout the course of a year. It is unlikely that the creek chub observed in the ditches make up 20 percent of the local population or even occupy the ditches on the site throughout the year. With HQs of most of the surface water and sediment COPCs less than 10 and based on very conservative assumptions, none was considered to be a COC.

There is a low likelihood of risk to the deer mouse and creek chub individuals that may use the site as a result of COPC concentrations in soil, surface water, and sediment.

8.0 SUMMARY

This section summarizes the information regarding chemical impacts to environmental media at SEADs 16 and 17. The results of chemical fate and transport modeling for on-site inorganic elements are discussed, and reviews of the human health and ecological risk assessments that were performed for these sites are presented. Detailed descriptions of the chemical impacts at the sites, the environmental fate and transport modeling, and the risk characterizations are presented in sections 4.0, 5.0, 6.0, and 7.0 of this report.

8.1 SEAD-16

The following sub-sections summarize the findings of the RI at SEAD-16.

8.1.1 Summary of the Extent of Impacts at SEAD-16

The nature and extent of the constituents of concern at SEAD-16 were evaluated through a comprehensive field investigation program. The media investigated at SEAD-16 included ambient air (collected from indoor and outdoor sampling locations), building materials (collected from interior building surfaces and building debris), surface and subsurface soils (collected from surface soil samples and soil borings), surface water and sediment (collected from the drainage ditches surrounding the site), and groundwater (collected from groundwater monitoring wells installed around the buildings at SEAD-16). The primary constituents of concern at SEAD-16 are the inorganic elements arsenic, copper, lead, and zinc in surface soils and copper, lead, and zinc in surface water. Also of significance are the detected concentrations of PAH compounds in surface soils and sediments and inorganic elements, PAHs, and nitroaromatics in the building samples. All of these constituents of concern are believed to have been released to the environment during the Former Deactivation Furnace's period of operation (approximately 1945 to the mid 1960s).

Air

Copper and lead were the only inorganic elements that were detected in the indoor air samples at concentrations that were significantly above (by a factor of three to four) their respective concentrations detected in the single background outdoor sample. However, neither copper, nor lead, nor any other element or compound, were detected in the indoor air samples at concentrations that were above their respective threshold limit value-time weighted average (TLV-TWA) values.

Solids

Antimony, copper, lead, and zinc were detected at concentrations that exceeded their respective TAGM values in all 12 building samples collected from the Abandoned Deactivation Furnace Building (Building S-311) and the Process Support Building (Building 366). PAHs and nitroaromatics were also detected at significantly elevated concentrations in the building samples. The highest total of carcinogenic PAHs that were detected in a single sample was 54,000 ug/Kg, which was reported for a propellant residue sample collected from Building 366. The highest concentration of nitroaromatics was found in the vacuum system recovery vats in Building 366, where 2,4-dinitrotoluene was found at concentrations of 19,000,000 ug/Kg and 3,700,000 ug/Kg in two separate samples. Asbestos was also detected at 13 locations in the two buildings in such materials as pipe insulation, roofing material, and floor tiles.

Soils

Arsenic, copper, lead, and zinc were detected in almost all of the surface soil samples at concentrations above their respective TAGM values. Copper and lead were also found to be pervasive in the subsurface soil samples. In all instances, the detected concentrations of inorganic elements were found to be highest in those samples collected adjacent to the northeastern side of the Abandoned Deactivation Furnace Building. The distribution of elevated concentrations of PAHs and nitroaromatic compounds also had this same distribution pattern. The highest concentrations of PAHs was detected in the surface soil samples collected adjacent to the northwestern corner of the Abandoned Deactivation Furnace Building, and, the majority of elevated nitroaromatics concentrations were detected in the surface soil samples collected around and in between the Abandoned Deactivation Furnace Building and the Process Support Building. One exception to this pattern was the highest concentration of 2,4-dinitrotoluene (7,700 ug/Kg), which was detected in the eastern most surface soil sample, collected along the site access road in close proximity to the site's perimeter fence.

While there is some evidence that inorganics and PAHs may have been discharged from the furnace emissions stack and deposited in surface soils at SEAD-16, the chemical distribution patterns described above indicate that the most significant on-site surface soil impacts resulted from the operations that were performed within and in close proximity to the Abandoned Deactivation Furnace Building and the Process Support building.

Surface Water

Cadmium, copper, iron, lead, selenium, and zinc were detected at elevated concentrations in a minimum of three of the 10 surface water samples collected at SEAD-16. The highest concentrations of cadmium (2 ug/L), copper (424 ug/L), lead (813 ug/L), and zinc (253 ug/L) were detected in the surface water sample collected from the drainage ditch located southeast of the Abandoned Deactivation Furnace Building. Three of these elements (copper, lead, and zinc) were also found to be widely distributed in the SEAD-16 surface soils.

In general, most of the significantly elevated concentrations of inorganic elements in the surface water samples were collected from the two drainage ditches that are closest to, and south of, the Abandoned Deactivation Furnace Building. This pattern of inorganic element distribution in SEAD-16 surface waters, as well the wide distribution of these elements in the SEAD-16 surface soil samples, indicates that the on-site surface soils are the likely source area for the inorganic elements found in the surface water samples, and, that the primary on-site overland flow direction during precipitation events is to the south and south-east.

Sediment

Sediment impacts were primarily from SVOCs and pesticides, and were found at elevated concentrations in all of the drainage ditches that were investigated at SEAD-16. The highest concentrations of SVOC and pesticide compounds were detected in the sediment sample collected from the northeast corner of the Abandoned Deactivation Furnace Building, though no trend was observed in the spatial distribution of elevated SVOC or pesticide concentrations throughout the site. This data indicates that past operating processes in the Abandoned Deactivation Furnace building did not contribute directly to the distribution of these compounds throughout the site. Rather, the SVOC impacts may have resulted from the use of vehicles for site operations (including locomotives, transport trucks, and automobiles) and the pesticide impacts are likely to have occurred from on-site pesticide applications.

Groundwater

Seven inorganic elements were detected in the groundwater samples at concentrations that exceeded NYS Class GA or federal MCL standards. They are aluminum, antimony, iron, lead, manganese, sodium, and thallium. Aluminum, iron, and manganese concentrations exceeded their standards in the upgradient and downgradient groundwater monitoring wells. The concentrations detected in the up gradient samples are similar to or greater than those found in the downgradient samples, and therefore, the source of these inorganics in groundwater is not likely to be in SEAD-16. [It is noteworthy that the hydrologic data indicate that in the northeastern portion of the site there is no single, well-defined direction of groundwater flow that is sustained throughout the year.] Antimony and lead were detected at concentrations that were above their standards in one well only, MW16-3, which is located adjacent to the southern portion of the Abandoned Deactivation Furnace Building. Thallium was detected at elevated concentrations in three groundwater monitoring wells, MW16-2, MW16-6, and MW16-7, which area also located in close proximity to the Abandoned Deactivation Furnace Building. These data indicate that the source of the antimony, lead, and thallium in groundwater is likely to be in or near the building, though no distribution pattern in groundwater for any of these elements is apparent. Sodium was detected at an elevated concentration (over an order of magnitude above its respective NYS Class GA criteria) in a single groundwater monitoring well, MW16-6. The source of this single sodium exceedance is unknown.

8.1.2 Fate and Transport of the Constituents of Concern at SEAD-16

Cursory transport modeling of inorganic chemicals in surface soils was performed at SEAD-16 to determine if the concentrations of these inorganics posed a future threat to groundwater at the site. Transport modeling of the other parameters was not performed for this RI.

The fate and transport modeling included the following tasks: 1) development of a conceptual model for transport simulations; 2) estimation of the water balance (i.e., annual infiltration) for the site using methods developed by EPA (1975) and Thornthwaite and Mather (1957); 3) estimation of the mass impact of selected inorganics on the underlying groundwater using the VLEACH model; and 4) estimate the concentration of the inorganics in the groundwater beneath the site using the SUMMERS model. The VLEACH and SUMMERS model results presented below are for the "base scenario", which consists of the best estimates for all input parameters for the models.

The results of the VLEACH modeling for SEAD-16 yield the maximum leaching concentrations of each of the seven inorganics simulated at a depth immediately above the water table. These results indicate that the highest leaching concentrations were for lead and copper (55.73 mg/l and 65.27 mg/l, respectively), each of which is above its applicable groundwater standard. The times at which the maximum leaching concentrations would occur according to the VLEACH model are 785 years for lead and 170 years for copper. The maximum leaching concentrations of several other metals (arsenic, zinc, and cadmium) were also above their respective groundwater standards. According to the VLEACH model results, the times at which these maximums would occur ranged between 20 and 130 years. The leaching concentrations for antimony and mercury were below their respective standards.

It is noteworthy that in the VLEACH simulations for lead, copper, and zinc the solubility was exceeded in several vertical cells of the polygon because of the large initial soil concentrations. This also resulted in final leaching concentrations that were above the estimated solubility for the respective metals, noting that the exact speciation of metals at SEAD-16, and thus the solubility, is not known. Considering that the solubility estimates for the metals are approximate, the aqueous concentrations of these metals calculated by VLEACH can be considered to be conservative.

The maximum leaching concentrations were used as input parameters into the SUMMERS Model to calculate the concentrations of the various inorganics in the aquifer as a result of instantaneous mixing. By using the maximum leaching concentrations a worst-case impact for each of the inorganics could be evaluated using the SUMMERS Model.

The results of the SUMMERS modeling for SEAD-16 yields the concentrations of the seven inorganics in the aquifer immediately below the source polygon, assuming instantaneous mixing. The modeling results indicate that lead, copper and zinc may exceed their respective groundwater standards in the aquifer in the future. The model predicts that lead will reach a maximum concentration in the aquifer of 2,721 µg/l in approximately 785 years. This concentration exceeds the EPA MCL (which is actually a guidance value) of 15 µg/l for lead. In addition, the model predicts that it will take approximately 205 years before the MCL for lead is exceeded. The maximums concentrations for copper and zinc are predicted to be 3,190 µg/l (in 175 years) and 1,428 µg/l (in 130 years), which are also above their respective standards of 200 µg/l and 300 µg/l. And, the model results indicate that it will take 85 years and 65 years to before the groundwater standards for copper and zinc, respectively, are exceeded. The concentrations of the other metals (antimony, arsenic, mercury, and cadmium) were predicted to be below their respective groundwater standards.

In summary, the SUMMERS model results provide insight as to the inorganics that are likely to pose a future threat to groundwater at SEAD-16. And, considering that the leaching concentrations of the metals calculated by VLEACH are estimates, (due to the uncertainty associated with the speciation and thus, the solubility, of the metals), the modeling results indicate that a future threat to groundwater may exist from leaching of lead, copper and zinc in surface soils at SEAD-16.

8.1.3 Human Health Risk Assessment at SEAD-16

Human health risk calculations were performed for six potential exposure scenarios:

1. Current on-site worker,
2. Future on-site industrial worker,
3. Future on-site construction worker,
4. Future on-site trespasser,
5. Future child attending an on-site day care center, and
6. Future worker at the day care center.

The current on-site worker exposure scenario involved calculation of risks via three pathways: inhalation of particulates in ambient air, ingestion of soil, and dermal contact with soil. For this exposure scenario, the calculated RME excess cancer risk of 1 $\times 10^{-6}$ is within the lower bounds of the USEPA target risk range of 10^{-4} and 10^{-6}, and the RME hazard index of 0.05 is below the USEPA target value of 1.

The future on-site industrial worker exposure scenario involved the calculation of risks via four pathways: inhalation of particulates in indoor air, ingestion of surface dust, dermal contact with surface dust and ingestion of groundwater. The calculated excess cancer risk to future industrial workers from these pathways is 5 $\times 10^{-3}$ (RME) and 6 $\times 10^{-4}$ (CT). These risks exceed the USEPA target range of 10^{-4} to 10^{-6} and are due primarily to ingestion of indoor surface dust. The cumulative non-cancer hazard index from all pathways is 20 (RME) and 9 (CT). These hazard indices exceed the USEPA target value of 1 and are due primarily to the ingestion of surface dust followed by dermal contact with surface dust and ingestion of groundwater. 2,4-Dinitrotoluene via ingestion of surface dust is the primary cause of both the carcinogenic and non-carcinogenic risk. The carcinogenic risk estimate from ingestion of surface dust based on 2,4-dinitrotoluene alone is 5 x 10^{-3} (RME) and 6 x 10^{-4} (CT), while its non-cancer hazard quotient (HQ) is 9 (RME), and 4 (CT). Antimony (RME HQ = 4, CT HQ = 2) and copper (RME HQ = 2, CT HQ = 0.9) are also significant contributors to the hazard index via ingestion of surface dust. For dermal contact with surface dust, cadmium is the primary contributor of non-cancer risk (RME HQ = 1, CT HQ = 0.2). For ingestion of groundwater, thallium is the primary contributor of non-cancer risk (RME HQ = 2, CT HQ = 1). These results indicate that continuous worker occupancy of the Abandoned Deactivation Furnace building, while even using the less conservative CT exposure factors, is unacceptable in its current state.

The future construction worker exposure scenario involved the calculation of risks via three pathways: inhalation of particulates in ambient air, ingestion of soil, and dermal contact with soil. The calculated excess cancer risk to future construction workers from these pathways is 3 x10^{-6} (RME) and 6 x10^{-7} (CT). These risks are within or below the USEPA target range of 10^{-4} to 10^{-6}. The cumulative non-cancer hazard index from all pathways is 1 (RME) and 0.6 (CT). Only the RME hazard index slightly exceeds the USEPA target value of 1, which is due to the sum of the RME HQ values calculated for mercury (HQ=0.4 in the inhalation of particulates in ambient air pathway) and antimony (HQ=0.6 in the ingestion of soil pathway).

The future trespasser exposure scenario involved the calculation of risks via six pathways: inhalation of particulates in ambient air, ingestion of soil, dermal contact with soil, dermal contact with surface water, ingestion of sediment, and dermal contact with sediment. The calculated excess cancer risk to the future trespasser from these pathways is 3 x10^{-6} (RME) and 2 x10^{-7} (CT). These risks are within or below the USEPA target range of 10^{-4} to 10^{-6} . The cumulative non-cancer hazard index from all pathways is 0.3 (RME) and 0.09 (CT). These hazard indices are also below the USEPA target value of 1.

The future day care center child scenario involved the calculation of risks via four pathways: inhalation of particulates in ambient air, ingestion of soil, dermal contact with soil and ingestion of groundwater. The calculated excess cancer risk to the future day care child from these pathways is 6 x 10^{-5} (RME) and 2 x 10^{-5} (CT). These risks are within the USEPA target range of 10^{-4} to 10^{-6}. The cumulative non-cancer hazard index from all pathways is 6 (RME) and 5 (CT). These hazard indices exceed the USEPA target value of 1 and are due primarily to ingestion of groundwater, followed by ingestion of soil. For ingestion of groundwater, thallium is the primary contributor of non-cancer risk (RME HQ = 4, CT HQ = 3). For ingestion of soil, antimony is the primary contributor of non-cancer risk (RME HQ = 1, CT HQ = 0.5).

The future day care center worker scenario involved the calculation of risks via the same four pathways as the day care child The calculated excess cancer risk to the future day care worker from these pathways is 6 x 10^{-5} (RME) and 1 x 10^{-5} (CT). These risks are within the USEPA target range of 10^{-4} to 10^{-6}. The cumulative non-cancer hazard index from all pathways is 2 for both the RME and CT. These hazard indices exceed the USEPA target value of 1 and are due to ingestion of groundwater. Thallium is the primary contributor of non-cancer risk (RME HQ = 2, CT HQ = 1).

8.1.4 <u>Ecological Risk Assessment at SEAD-16</u>

The ecological risk assessment at SEAD-16 included both a qualitative and quantitative assessment of the ecological status of the SEAD-16 study area. As part of the RI field program, a study area measuring two miles in radius about the site was evaluated to characterize the local flora and fauna. This evaluation included vegetation surveys, wetlands delineation, identification of taxa that use or frequent the study area, and a review of any threatened, endangered, or sensitive species that may use or frequent the study area. The conclusions determined from these field efforts indicate a diverse and healthy environment within the whole of the study area. No overt acute toxic impacts were evidenced during the field evaluations. Also, there are no threatened, endangered, or sensitive species that would be expected to inhabit or frequent the site.

The quantitative evaluation involved the calculation of ecological quotients for the deer mouse in a soil exposure scenario and the creek chub in a surface water exposure scenario and a sediment exposure scenario. Each of these exposure scenarios identified several of the on-site inorganic elements as ecological COCs. They are lead and mercury for the soil exposure scenario, iron and lead in the surface water exposure scenario, and, antimony, copper, lead, and mercury in the sediment exposure scenario. In addition, the organic compounds endosulfan I, endosulfan II, and endosulfan sulfate were identified as COCs in the sediment exposure scenario. The hazard quotients calculated for these elements, in their respective media, indicate that a low to significant potential for adverse effects exists for the proximate ecological assessment endpoints (the deer mouse and the creek chub). However, given the conservative nature in which the ecological hazard quotients were calculated for these proximate assessment endpoints, it is unlikely that a significant population of these proximate assessment endpoints are being affected by the ecological COCs at

SEAD-16. Further, since the general habitat quality of SEAD-16 is poor, it is not likely that this site supports a significant portion (greater than 20%) of the ultimate assessment endpoint: the community of species that occupies the area surrounding and including the site.

In summary, the ecological field evaluations at SEAD-16 indicate a diverse and healthy environment within the whole of the study area, that no overt acute toxic impacts are evidenced, and that there are no threatened, endangered, or sensitive species that would be expected to inhabit or frequent the site. The quantitative ecological assessment indicates that the proximate assessment endpoints at SEAD-16 have a low to significant potential for adverse effects from exposure to SEAD-16 ecological COCs, however, those exposed individuals are not likely to significantly affect the ultimate assessment endpoint, which is the community of species that occupies the area surrounding and including SEAD-16.

8.2 SEAD-17

The following sub-sections summarize the findings of the RI at SEAD-17

8.2.1 Summary of the Extent of Impacts at SEAD-17

The nature and extent of the constituents of concern at SEAD-17 were evaluated through a comprehensive field investigation program. The media investigated at SEAD-17 included surface and subsurface soils (collected from surface soil samples and soil borings), surface water and sediment (collected from the drainage ditches surrounding the site), and groundwater (collected from groundwater monitoring wells installed around the buildings at SEAD-17). The primary constituents of concern at SEAD-17 are inorganic elements in soils, mainly antimony, arsenic, copper, lead, mercury, and zinc. Also of significance are the detected concentrations of PAH and pesticide compounds in sediments. All of these are believed to have been released to the environment during the Active Deactivation Furnace's period of operation (approximately 1962 to 1989).

Soils

Antimony, arsenic, copper, lead, mercury and zinc were detected in almost all of the surface soil samples at concentrations above their respective TAGM values. Lead was detected in all of the subsurface soil samples at concentrations that exceeded its TAGM value. In all instances, the detected concentrations of inorganic elements were found to be highest in those samples collected in close proximity to the Active Deactivation Furnace Building, although some of the highest concentrations were located immediately to the southwest of the building. A drainage pipe, which drains the retort inside the Active Deactivation Building, discharges to the southwest of the building, and may explain the presence of the high inorganic element concentrations in the nearby surface soils. Because the Active Deactivation Furnace Building has very few access points, and since the most significant impacts from inorganics are generally equally distributed around the building, it is likely that emissions fallout from the stack on the building is the source of these inorganics. However, because the building at SEAD-17 currently has emission controls for the stack, it likely that these emission occurred prior to installation of these controls.

Surface Water

Lead and selenium were detected at elevated concentrations in a minimum of three of the 10 surface water samples collected at SEAD-17. The highest concentrations of lead (37.1 ug/L), and selenium (3.4 ug/L) were detected in the surface water samples collected from the drainage ditch located between the Active Deactivation Furnace Building and the above ground fuel oil tank. Lead was also found to be widely distributed in the SEAD-17 surface soils.

In general, most of the elevated concentrations of inorganic elements in the surface water samples were collected from the drainage ditch located between the Active Deactivation Furnace Building and the above ground fuel oil tank. This drainage ditch also collects the over land runoff from the deactivation furnace's retort drainage pipe. This occurrence of inorganic elements in the surface waters to the south of SEAD-17, as well as the wide distribution of inorganic elements in the SEAD-17 surface soil samples, indicates that the on-site surface soils are the likely source area for the inorganic elements found in the surface water samples, and, that the primary on-site overland flow direction during precipitation events is towards the drainage ditch located between the Active Deactivation Furnace Building and the above ground fuel oil tank.

Sediment

Sediment impacts were primarily from pesticides and inorganics, and were found at elevated concentrations in all of the drainage ditches that were investigated at SEAD-17. All of the elevated pesticide compound concentrations were detected in the sediment samples collected from the northern most and western most drainage ditches. None were detected at elevated concentrations at locations that were in close proximity to the Active Deactivation Furnace Building. This spatial distribution pattern indicates that the operating processes in the Active Deactivation Furnace did not contribut to the dispersion of pesticide compounds at SEAD-17. Rather, the pesticide compound impacts are likely to have occurred from on-site pesticide applications. This pesticide data indicate that past operating processes in the Abandoned Deactivation Furnace building did not contribute directly to the distribution of these compounds throughout the site.

Cadmium, copper, iron, lead, and nickel were detected in almost all of the SEAD-17 sediment samples at concentrations that exceed their respective criteria values. Copper and lead were found to be pervasive in the on-site surface soil samples and the site's surface soils are the likely source of the SEAD-17 sediment impacts for these two elements. Though cadmium and nickel are impacting SEAD-17 soils at levels that are not as significant as copper and lead, both cadmium and nickel were detected in numerous surface soil samples at concentration that did exceed TAGM values. Therefore, the source of cadmium and nickel in the SEAD-17 sediments is also likely to be the on-site surface soils. The detected concentrations of iron in the SEAD-17 sediments are very similar to those detected in the site's surface soils, and only a few of the site's surface soil samples slightly exceeded the TAGM value for iron Based upon this comparison, the iron concentrations in the SEAD-17 sediments are likely the results of surface soil run off, and based upon the surface soil data, the past operations at the Active Deactivation Furnace do not appear to have caused any iron impacts to the site.

Groundwater

Generally, the groundwater at SEAD-17 has not been significantly impacted by any of the chemical constituents. Low concentrations of SVOCs were detected, and two inorganic elements, thallium and manganese, exceeded their respected MCL criteria values by a factor of 3.5 or less. No VOCs, pesticides, PCBs or nitroaromatics were detected in the samples.

8.2.2 Fate and Transport of the Constituents of Concern at SEAD-17

Cursory transport modeling of inorganic chemicals in surface soils was performed at SEAD-17 to determine if the concentrations of these inorganics posed a future threat to groundwater at the site. Transport modeling of the other parameters was not performed for this RI.

The fate and transport modeling included the following tasks: 1) development of a conceptual model for transport simulations; 2) estimation of the water balance (i.e., annual infiltration) for the site using methods developed by EPA (1975) and Thornthwaite and Mather (1957); 3) estimation of the mass impact of selected inorganics on the underlying groundwater using the VLEACH model; and 4) estimate the concentration of the inorganics in the groundwater beneath the site using the SUMMERS model. The VLEACH and SUMMERS model results presented below are for the "base scenario", which consists of the best estimates for all input parameters for the models.

The results of the VLEACH modeling at SEAD-17 yield the maximum leaching concentrations of each of the six inorganics simulated at a depth immediately above the water table. These results indicate that the highest leaching concentration was for zinc (8.20 mg/l) and the concentrations for lead and copper were the next highest at 3.60 mg/l and 3.41 mg/l, respectively. All three of these concentrations are above their applicable groundwater standards. While the times at which the maximum leaching concentrations would occur for copper and zinc were between 120 and 170 years, the time for the lead maximum was predicted at 785 years. The maximum leaching concentration of cadmium was also above its respective groundwater standard (at 55 years). Maximum leaching concentrations for antimony and silver were below their respective standards.

In the VLEACH simulations for lead and zinc, the solubility was exceeded in several of the vertical cells in the polygon because of the large initial soil concentrations. This also resulted in a final leaching concentration for zinc that was above its estimated solubility, noting that the exact speciation of metals at SEAD-17, and thus the solubility, is not known. Considering that the solubility estimates for the metals are approximate, the aqueous concentrations of these metals calculated by VLEACH can be considered to be conservative.

The maximum leaching concentrations were used as input parameters into the SUMMERS Model to calculate the concentrations of the various inorganics in the aquifer as a result of instantaneous mixing. By using the maximum leaching concentrations a worst-case impact for each of the inorganics could be evaluated using the SUMMERS Model.

The results of the SUMMERS modeling for SEAD-17 yield the concentrations of the six inorganics in the aquifer immediately below the source polygon, assuming instantaneous mixing. The modeling results indicate that lead, zinc, and cadmium may exceed their respective groundwater standards in the aquifer in the future, although the exceedances were of significantly lower magnitude compared to those at SEAD-16. The model predicts that lead will reach a maximum concentration in the aquifer of 274 µg/l in approximately 785 years. This concentration exceeds the EPA guidance value of 15 µg/l for lead. Also, the model predicts that it will take approximately 340 years before the MCL for lead is exceeded. The maximum concentrations for zinc and cadmium are predicted to be 578 µg/l (in 120 years) and 14.65 µg/l (in 55 years), which are also above their respective standards of 300 µg/l and 5 µg/l. The concentrations of zinc and cadmium in the aquifer are predicted to exceed their respective groundwater standards in 50 years and 30 years. The concentrations of the other metals (copper, antimony, and silver) were predicted to be below their respective groundwater standards.

In summary, the SUMMERS model results provide insight as to the inorganics that are likely to pose a future threat to groundwater at SEAD-17. And, considering that the leaching concentrations of the metals calculated by VLEACH are estimates (due to the uncertainty associated with the speciation and thus, the solubility, of the metals), the modeling results indicate that a future threat to groundwater may exist from leaching of lead, zinc, and cadmium in surface soils at SEAD-17.

8.2.3 Human Health Risk Assessment at SEAD-17

Human health risk calculations were performed for four potential exposure scenarios:

1. Current on-site worker,
2. Future on-site industrial worker,
3. Future on-site construction worker,
4. Future on-site child trespasser,
5. Future child attending an on-site day care center, and
6. Future worker at the day care center.

The current on-site worker exposure scenario involved calculation of risks via three pathways: inhalation of particulates in ambient air, ingestion of soil, and dermal contact with soil. For this exposure scenario, the calculated RME excess cancer risk was 5 x10^{-7} and the calculated CT excess cancer risk was 3 $\times 10^{-8}$. Each is below the USEPA target risk range of 10^{-4} and 10^{-6}. The calculated RME hazard index of 0.007 and the calculated CT hazard index of 0.002 are also both below the USEPA target value of 1.

The future on-site industrial worker exposure scenario involved the calculation of risks via three pathways: inhalation of particulates in ambient air, ingestion of soil, and dermal contact with soil. For this exposure scenario, the calculated RME excess cancer risk was 6 $\times 10^{-6}$ and the calculated CT excess cancer risk was 7 $\times 10^{-7}$. Each is within or below the USEPA target risk range of 10^{-4} and 10^{-6}. The calculated RME hazard index of 0.08 and the calculated CT hazard index of 0.04 are also both below the USEPA target value of 1.

The future construction worker exposure scenario involved the calculation of risks via three pathways: inhalation of particulates in ambient air, ingestion of soil, and dermal contact with soil. The calculated excess cancer risk to future construction workers from these pathways is 1 $\times 10^{-6}$ (RME) and 2 $\times 10^{-7}$ (CT). These risks are within or below the USEPA target range of 10^{-4} to 10^{-6}. The cumulative non-cancer hazard index from all pathways is 0.3 (RME) and 0.08 (CT). Both are also below the USEPA target value of one.

The future trespasser exposure scenario involved the calculation of risks via six pathways: inhalation of particulates in ambient air, ingestion of soil, dermal contact with soil, dermal contact with surface water, ingestion of sediment, and dermal contact with sediment. The calculated excess cancer risk to the future trespasser from these pathways is 9 $\times 10^{-7}$ (RME) and 4 $\times 10^{-8}$ (CT). These risks are below the USEPA target range of 10^{-4} to 10^{-6} . The cumulative non-cancer hazard index from all pathways is 0.1 (RME) and 0.03 (CT). These hazard indices are also below the USEPA target value of 1.

The future day care center child scenario involved the calculation of risks via four pathways: inhalation of particulates in ambient air, ingestion of soil, dermal contact with soil and ingestion of groundwater. The calculated excess cancer risk to the future day care child from these pathways is 1×10^{-5} (RME) and 3×10^{-6} (CT). These risks are within the USEPA target range of 10^{-4} to 10^{-6}. The cumulative non-cancer hazard index from all pathways is 0.7 (RME) and 0.3 (CT). These hazard indices are below the USEPA target value of 1.

The future day care center worker scenario involved the calculation of risks via the same four pathways as the day care child. The calculated excess cancer risk to the future day care worker from these pathways is 6×10^{-6} (RME) and 7×10^{-7} (CT). These risks are within or below the

USEPA target range of 10^{-4} to 10^{-6}. The cumulative non-cancer hazard index from all pathways is 0.08 (RME) and 0.03 (CT). These hazard indices are below the USEPA target value of 1.

8.2.4 Ecological risk Assessment at SEAD-17

The ecological risk assessment at SEAD-17 included both a qualitative and quantitative assessment of the ecological status of the SEAD-17 study area. As part of the RI field program, a study area measuring two miles in radius about the site was evaluated to characterize the local flora and fauna. This evaluation included vegetation surveys, wetlands delineation, identification of taxa that use or frequent the study area, and a review of any threatened, endangered, or sensitive species that may use or frequent the study area. The conclusions determined from these field efforts indicate a diverse and healthy environment within the whole of the study area. No overt acute toxic impacts were evidenced during the field evaluations. Also, there are no threatened, endangered, or sensitive species that would be expected to inhabit or frequent the site.

The quantitative evaluation involved the calculation of ecological quotients for the deer mouse in a soil exposure scenario and the creek chub in a surface water exposure scenario and a sediment exposure scenario. Each of these exposure scenarios identified several of the on-site inorganic elements and the organic compounds ensosulfan I and endosulfan II as having ecological hazard quotients that were moderately above the acceptable level of 1. However, based upon the conservative nature by which the toxicity reference values were calculated, and because SEAD-17 does not provide quality wildlife habitat, none of the COPCs at SEAD-17 were considered as ecological COCs.

In summary, the ecological field evaluations at SEAD-17 indicate that a diverse and healthy environment exists within the whole of the study area, that no overt acute toxic impacts were evidenced, and that there are no threatened, endangered, or sensitive species that would be expected to inhabit or frequent the site. The quantitative ecological assessment indicates that the proximate assessment endpoints at SEAD-17 have a low potential for adverse effects from exposure to a limited number of SEAD-17 ecological COPCs, however, based upon the conservative nature of the ecological assessment, and the poor habitat afforded by SEAD-17, none of the SEAD-17 COPCs were considered to be ecological COCs. Additionally, based again upon the conservative nature of the ecological assessment and the poor habitat of SEAD-17, neither the current nor the future site conditions are likely to affect the ultimate assessment endpoint, which is the community of species that occupies the area surrounding and including SEAD-17.