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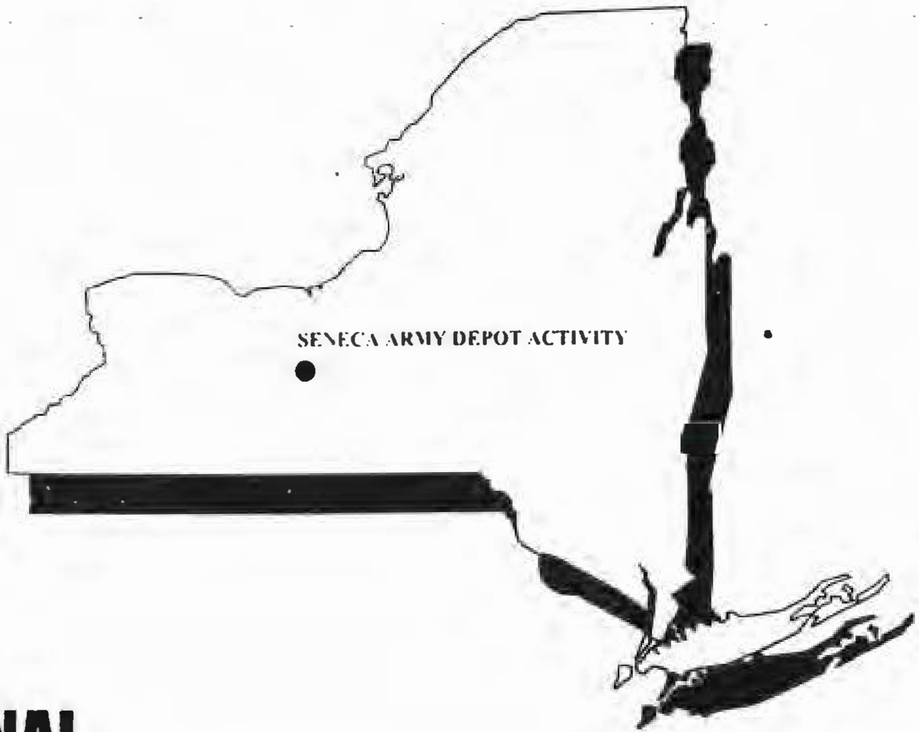
U.S. ARMY ENGINEER DIVISION
HUNTSVILLE, ALABAMA



FINAL

SUPERFUND PROPOSED PLAN FOR
THE ASH LANDFILL
AT THE SENECA ARMY DEPOT ACTIVITY (SEDA)
Romulus, New York

CONTRACT NO. DACA87-92-D-0022
DELIVERY ORDER NO. 0010

JUNE 2001

PARSONS INFRASTRUCTURE & TECHNOLOGY GROUP INC.

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

June 15, 2001

Commander
Seneca Army Depot Activity (SEDA)
Building 123
BRAC Environmental Coordinator
ATTN: SIOSE-BEC (Mr. Stephen Absolom)
Romulus, NY 14541

SUBJECT: Seneca Army Depot Activity; Final Proposed Remedial Action Plan (PRAP) for the Ash Landfill Operable Unit Including Sites (SEAD-3), (SEAD-6), (SEAD-8), (SEAD-14) and (SEAD-15)

Dear Mr. Absolom:

Parsons Engineering Science Inc. (Parsons) is pleased to submit the Final Proposed Remedial Action Plan (PRAP) for the Ash Landfill Operable Unit. This operable unit includes sites designated as SEAD-3, SEAD-6, SEAD-8, SEAD-14 and SEAD-15 at the Seneca Army Depot Activity (SEDA) located in Romulus, New York. Also included are responses to comments on the Draft Final Proposed Remedial Action Plan (PRAP) for the Ash Landfill Operable Unit. The responses to these comments have been incorporated into the final version of the PRAP. The response to comments on the Draft Feasibility Memorandum for Groundwater Remediation Alternatives using Zero Valence Iron Continuous Reactive Wall at the Ash Landfill will be provided separately.

This work was performed in accordance with the Scope of Work (SOW) for Delivery Order 0010 to Parsons Contract DACA87-92-0022. Parsons appreciates the opportunity to provide you with this PRAP. Should you have any questions, please do not hesitate to call me at (781) 401-2229 to discuss them.

Sincerely,

PARSONS ENGINEERING SCIENCE, INC.

Todd Heino, P.E.
Project Manager

cc: Major Sheets/ CEHNC-PM
R. Battaglia, USACE, New York District
K. Hoddinott, USACHPPM
K. Healy, CEHNC-EDCS-G

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PARSONS

FINAL SUPERFUND PROPOSED PLAN
FOR
THE ASH LANDFILL

SENECA ARMY DEPOT ACTIVITY
ROMULUS, NEW YORK

Prepared For:

Army Corps of Engineers
4820 University Square
Huntsville, Alabama

Prepared By:

Parsons Engineering Science, Inc.
30 Dan Road
Canton, Massachusetts

June 2001

SUPERFUND PROPOSED PLAN
The Ash Landfill at the
Seneca Army Depot Activity (SEDA)
Romulus, New York

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SUPERFUND PROPOSED PLAN

The ASH LANDFILL at the SENECA ARMY DEPOT ACTIVITY (SEDA) Romulus New York

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PURPOSE OF PROPOSED PLAN

This Proposed Plan describes the alternatives considered for remediation at the former Ash Landfill Operable Unit (OU) located within the Seneca Army Depot Activity (SEDA). The plan identifies the preferred remedial option with the rationale for its preference. The Proposed Plan was developed by representatives of the U. S. Army with support from the U.S. Environmental Protection Agency (EPA) and the New York State Department of Environmental Conservation (NYSDEC). The U.S. Army is issuing this Proposed Plan as part of its public participation responsibilities under Section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended, and Section 300.430(f) of the National Contingency Plan (NCP). The options summarized here are described in the remedial investigation and feasibility study (RI/FS) report, which should be consulted for a more detailed description of all the options. The RI/FS is contained in the Administrative Record, which is available for public review at the Town of Willard Public Library information repository.

This Proposed Plan is being provided to inform the public of the U.S. Army's preferred remedial alternative. This document is intended to solicit public comments pertaining to all the remedial options evaluated, as well as to specify the Army's preferred remedial option.
The remedy described in this Proposed Plan is the preferred remedy for the site. Changes to the preferred remedy or from the preferred remedy to another remedy may be made if public comments or additional data indicate that such a change would result in a more appropriate remedial action. Public comments are solicited on all of the options considered in the detailed analysis of the RI/FS because EPA, NYSDEC, and the U.S. Army may select a remedy other than the preferred remedy. The final decision regarding the selected remedy will be made after the U.S. Army, the EPA and the NYSDEC have taken into consideration all public comments.

A brief description of the U.S Army's preferred remedy for the Ash Landfill is as follows:

- Excavation and off-site disposal of debris piles, establishment and maintenance of a vegetative soil cover for the Ash Landfill and the Non-Combustion Fill Landfill (NCFL) for source control;
- Installation of three in-situ permeable reactive barrier walls filled with 100% zero valence iron, and maintenance of the proposed walls and the existing one for migration control of the groundwater plume;
- Contingency plan including additional monitoring and air sparging, as necessary;
- Institutional controls such as deed restrictions to prevent future owners from ingesting site groundwater and disturbing the landfill cap;
- Five-year reviews to evaluate whether the response actions remain protective of public health and the environment.

Dates to remember:
MARK YOUR CALENDAR

[enter start and completion dates of public comment period]
Public comment period on RI/FS report, Proposed Plan, and remedies considered

[enter public meeting date]
Public meeting at the [enter meeting location and time]

COMMUNITY ROLE IN SELECTION PROCESS

The U.S. Army, the EPA and the NYSDEC rely on public input to ensure that the concerns of the community are considered in selecting an effective remedy for each Superfund site. To this end, the RI/FS report, the Proposed Plan and supporting documentation have been made available to the public for a public comment period which begins on [enter public comment period start date] and concludes on [enter public comment period end date].

A public meeting will be held during the public comment period at the [meeting location] on [meeting date] at [meeting time] to present the conclusions of the RI/FS, to elaborate further on the reasons for recommending the preferred remedial option, and to receive public comments.

Comments received at the public meeting, as well as written comments, will be documented in the Responsiveness Summary Section of the Record of Decision (ROD)--the document which formalizes the selection of the remedy.

All written comments should be addressed to:

Mr. Stephen Absolom
BRAC Environmental Coordinator
Building 123
Seneca Army Depot Activity
Romulus, NY 14541-5001

Copies of the RI/FS report, Proposed Plan, and supporting documentation are available at the following repository:

Seneca Army Depot Activity
Building 116
5786 State Route 96
Romulus, NY 14541-5001
(607) 869-1309
Hours: M-F 8:30 am to 4:30 pm

SITE BACKGROUND

SEDA is a 10,587-acre military facility located in Seneca County, Romulus, New York that has been owned by the United States Government and operated by the Department of the Army since 1941. The facility is located in an uplands area, which forms a divide separating two of the New York Finger Lakes, Cayuga Lake on the east and Seneca Lake on the west. The elevation of the facility is approximately 600 feet above Mean Sea Level (MSL).

The Ash Landfill Operable Unit was initially estimated to encompass an area of approximately 130 acres. This larger area was investigated to ensure that no previously unknown waste disposal areas were overlooked. Following the remedial investigation, the area of the Ash Landfill Operable Unit was refocused to an area of approximately 23 acres. This area includes the Solid Waste Management Units (SWMUs) described below.

The Ash Landfill Operable Unit is located along the western boundary of SEDA. The Operable Unit is bounded on the north by Cemetery Road, on the east by the Seneca Army Depot Railroad line, and on the south by open grassland and brush. Beyond the depot's western boundary, on Smith Farm Road and along Route 96A, are farmland and residences. A map identifying the location of the site on the depot is included as **Figure 1.** A site map of the Ash Landfill Operable Unit, identifying the location of the SWMUs, is provided as **Figure 2.** The Ash Landfill Operable Unit is comprised of five SWMUs including: the Ash Cooling Pond (SEAD-3), the Ash Landfill (SEAD-6), the Non-Combustible Fill Landfill (NCFL) (SEAD-8), the Refuse Burning Pits (SEAD-14) and the Abandoned Solid Waste Incinerator Building (SEAD-15). SEAD-14 is also known as the Debris Piles. The Ash Landfill (SEAD-6) also includes a groundwater plume that emanated from the northern side of the landfill area.

According to the original SWMU Classification Report, SEAD-3 is a circular-bermed area approximately 50 feet in diameter. SEAD-6 is a kidney-shaped landfill approximately 550 feet by 300 feet (4 acres) in area. The groundwater plume associated with the Ash Landfill is approximately 18 acres. SEAD-8 is an area approximately 400 feet by 400 feet (3 acres) in area. SEAD-14 was originally thought to be two pits approximately 40 feet by 80 feet each however further investigation showed it to be three piles of burned trash. SEAD-15 is approximately 25 feet by 40 feet. The area that comprises the remaining 130-acres is a grassy shrub-covered area.

SEDA was proposed for the National Priority List (NPL) in July 1989. In August 1990, SEDA was finalized for listing, and was listed in Group 14 on the Federal Section of the NPL. The EPA, NYSDEC, and the Army entered into an agreement, called the Federal Facility Agreement (FFA), also known as the Interagency Agreement (IAG). This agreement determined that future investigations were to be based on CERCLA guidelines. The Resource Conservation and Recovery Act (RCRA) was considered to be an Applicable or Relevant and Appropriate Requirement (ARAR) pursuant to Section 121 of CERCLA. In October 1995, SEDA was designated as a facility to be closed under the provisions of the Base Realignment and Closure (BRAC) process.

Since 1941 the depot has been owned by the United States Government and operated by the Department of the Army. Prior to construction of the depot, the site was used for farming. From 1941 to 1974, uncontaminated trash was burned in a series of burn pits (SEAD-14), near the abandoned incinerator building (Building 2207), (SEAD-15). According to a U.S. Army Environmental Hygiene Agency (USAEHA) Interim Final Report, Groundwater Contamination Survey No. 38-26-0868-88 (July 1987), from 1941 until the late 1950's or early 1960's, the ash from the refuse burning pits was buried in the Ash Landfill (SEAD-6).

The incinerator building was built in 1974. Between 1974 and 1979, materials intended for disposal were transported to the incinerator. The incinerator was a multiple chamber, batch-fed 2,000 pound per hour capacity unit, which burned rubbish and garbage. The incinerator unit contained an automatic ram-type feeder, a refractory-lined furnace with secondary combustion and settling chamber, a reciprocating stoker, a residue conveyor for ash removal, combustion air fans, a wet gas scrubber, an induced draft fan, and a refractory-lined stack (USAEHA, 1975). Nearly all of the approximately 18 tons of refuse generated per week on the depot were incinerated. The source for the refuse was domestic waste from depot activities and family housing. Large items that could not be burned were disposed of at the NCFL (SEAD-8). The NCFL is approximately 2 acres and is located southeast of the incinerator building (immediately south of the SEDA railroad line). The NCFL was used as a disposal site for non-combustible materials, including construction debris, from 1969 until 1977.

Ashes and other residues from the incinerator were temporarily disposed of in an unlined cooling pond (SEAD-3) immediately north of the incinerator building. The cooling pond consisted of an unlined depression approximately 50 feet in diameter and approximately 6 to 8 feet deep. When the pond filled (approximately every 18 months), the fly ash and residues were removed, transported, and buried in the adjacent Ash Landfill, east of the cooling pond. The refuse was dumped in piles and occasionally spread and compacted. No daily or final cover was applied during operation. The active area of the Ash Landfill extended at least 500 feet north of the incinerator building, near a bend in a dirt road, based on an undated aerial photograph of the incinerator during operation. A fire destroyed the incinerator on May 8, 1979, and the landfill was subsequently closed. A vegetative cover, comprised of native soils and grasses, was observed over the Ash Landfill during the RI.

A grease pit disposal area near the eastern boundary of the site was used for disposal of cooking grease. Burn areas, surrounding the Ash Landfill, included areas of blackened soil, charred debris and areas of stressed or dead vegetation.

REMEDIAL INVESTIGATION SUMMARY

Parsons Engineering Science, Inc. (Parsons ES), originally known as the Parsons subsidiary C.T. Main (MAIN), was retained to provide environmental support services in 1990. Parsons ES, conducted the first phase of fieldwork, which was completed in January 1992. The RI report was prepared in two phases. The first document provided was the Preliminary Site Characterization Summary Report (PSCR) submitted on April 27, 1992. The PSCR constituted the first four chapters of the RI and was intended to provide a description of the site conditions, present the Phase 1 data, and identify any data gaps. The PSCR served as the basis for the second phase of data collection. Phase 2 fieldwork was completed by Parsons ES in April 1993. The final RI report was submitted on October 3, 1994.

The nature and extent of the constituents of concern at the Ash Landfill were evaluated through the comprehensive RI program. The primary media investigated at the Ash Landfill were soil, surface water and sediment from Kendaia Creek, on-site wetlands, drainage swales, and groundwater. The primary constituents of concern at the Ash Landfill are Volatile Organic Compounds (VOCs) (primarily chlorinated and aromatic compounds), semi volatile organics (mainly Polynuclear Aromatic Hydrocarbons (PAHs)), and, to a lesser degree, metals. The constituents of concern are believed to have been released to the environment during former activities conducted at the Ash Landfill Operable Unit. The source of the Volatile Organic Compounds was most likely the three alleged solvent dump areas located at the bend in the access road (Bend in the Road) northwest of the Ash Landfill. The source of the VOCs that were allegedly disposed in this area is unknown.

<u>Non-Time Critical Removal Action Summary</u>

A non-time critical removal action, also known as an Interim Removal Measure (IRM), was conducted by the Army between August 1994 and June 1995, under the requirements of the CERCLA, as amended. The removal action consisted of excavation and thermal treatment of VOC-impacted soils using Low Temperature Thermal Desorption (LTTD). The objectives of the removal action were to thermally treat VOCs and PAHs in soils at two source areas near the "Bend in the Road" where sampling identified elevated concentrations of VOCs and PAHs to be present. The non-time critical removal action reduced risk due to future exposure to these soils and prevented continued leaching of VOCs to groundwater associated with this operable unit. Cleanup requirements for soils were adopted from the NYSDEC Technical and Administrative Guidance Manual (TAGM) cleanup guidelines. The scope of the removal action is described in the "Action Memorandum, Ash Landfill Removal Action" (Parsons ES, 1993). The non-time critical removal action was conducted by IT Corporation on soils that were the source of a groundwater plume of VOCs. In July 1995, the final report for the Ash Landfill Immediate Response was prepared by IT Corporation. The treatment of soils involved two distinct source areas at the "Bend in the Road" area. Approximately 35,000 tons of soil were excavated from the two source areas and heated to 800-900°F in the LTTD system. After the soil was heated and cooled, soil was tested prior to backfilling into the excavation area. Following backfilling and proper grading for drainage control, a vegetative cover was established to prevent erosion. Sampling and analysis of the excavated and treated soil material indicated that these soils were successfully treated and met the VOC cleanup criteria (NYSDEC TAGM values) for the project. **Tables 1 through 4** list concentrations of constituents of concern in soil prior to and after the IRM as well as their respective NYSDEC TAGM values. These tables show that the concentrations of VOCs in soils after the IRM were lower than the concentrations of VOCs in soil prior to the IRM. Also, concentrations of VOCs in soils after the IRM were below NYSDEC TAGM values. The IRM thermal treatment project provided a positive benefit for the long-term remedial action by eliminating continued leaching of VOCs into groundwater and preventing further exposure to humans and wildlife. In the several years that have passed since the IRM, the positive benefits of the IRM have been observed as the concentration of groundwater in this area has decreased over 100 fold.

Treatment of wastewater and monitoring of air dispersion impacts were also performed as part of the non-time critical removal action. Wastewater in the excavation areas (consisting of infiltrating groundwater, precipitation, runoff, and water generated from other project operations) was collected, pumped, and treated by an on-site water treatment system prior to discharge in a nearby field. The treated water met the requirements of the NYSDEC groundwater criteria for a Class GA groundwater. Class GA groundwater means that the groundwater is suitable for use as a source of potable water.

Tables 1 through 4 provide a summary of soil data collected before and after the IRM. Each table includes the NYSDEC TAGM soil criteria, the count, (i.e. the number of valid samples included in the statistical evaluation), the maximum detected value, the 95th UCL of the mean and the arithmetic mean. Non-detected values were included in the statistical calculation as a detected value at one-half the detection limit.

The 95th UCL of the mean is a probabilistic estimate of the true mean of the site data. The 95th UCL of the mean is a function of the distribution of the data, the standard deviation and the number of samples that were collected. The more samples that are collected, the greater the likelihood that the true mean of the site data is represented by the 95th UCL of the mean. For risk assessment purposes, EPA recommends that the 95th UCL of the mean be used as a reasonable estimate of the exposure point concentration. If the 95th UCL of the mean is reduced by treatment, then presumably the risk would also be reduced.

The arithmetic mean is the sum of each value divided by the number of valid samples.

Table 1 provides an indication of the overall concentrations of chemicals in soil at the Ash Landfill Operable Unit prior to the IRM. This table includes soil data collected during the RI and includes all depths and all locations.

The IRM did not treat all the soil at the site. Only soil within the area known as the "Bend in the Road" was excavated and treated. Soil within this area was identified during the RI as the source of groundwater contamination. The soil data that was used for the statistical calculations in **Table 1** have been separated into **Tables 2** and **3** based on whether they were collected from the area identified as source of groundwater contamination (**Table 3**) or not (**Table 2**). One of the primary goals of the IRM was to eliminate the source of groundwater pollution. **Table 4** provides an indication of the concentrations of volatile and semi volatile constituents after the IRM was performed. **Table 4** does not include any of the RI data. This table was generated from the confirmation data collected following treatment, prior to replacement in the excavation. Comparison of the data from **Table 3** to **Table 4** provides an indication of the effectiveness of the IRM treatment process.

The maximum concentration of trichloroethene in soil at the "Bend in the Road" area, prior to the non-time critical removal action, was 540,000 ug/kg or 540 mg/kg (**Table 3**). The maximum concentration of trichloroethene in soil following thermal treatment was 46 ug/kg or 0.046 mg/kg (**Table 4**). This is a 99.99% reduction in TCE concentrations. Of the 156 valid soil samples collected from the treated soil, excluding duplicates, only this one sample was detected above the Practical Quantitation Limits (PQLs) of the analytical method. These samples represent soil from 150 cubic yard piles that had been thermally treated. The typical PQL for trichloroethene in soil was approximately 10 ug/kg. Following analytical documentation that treatment had been successful, the soil was placed back in the excavation.

Prior to full operation, a prove-out test was performed to document the effectiveness of the proposed thermal treatment technology and evaluate the potential for the treated soil to leach metals. Thermal treatment is not effective in removing metals from soil. A total of 89 post-treatment soil samples were collected and analyzed for the 8 Toxicity Characteristics Leaching Procedure (TCLP) metals following treatment. The 8 metals that are included in the TCLP test are: arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver.

The treated soil was tested to evaluate the potential for metals in soil to leach and ensure that the leachable levels did not exceed hazardous waste characteristic levels. The TCLP test is an EPA RCRA test that is used to assess the potential for a waste to leach. It is also used to classify waste as hazardous. The test results are expressed in mg/L, not mg/kg. This is because the test does not measure the total concentration of metals in soil, rather it measures the leachable amount of metals in soil. Of the 8 TCLP metals, lead was used as an indicator for metal impacts, due to the toxicity of lead, the potential for lead to leach and the concentrations of lead in soil that were measured during the RI.

The TCLP metal analytical data indicated that the maximum concentration of leachable lead in the soil samples associated with the IRM thermal treatment project was 814 ug/L. The regulatory limit for the RCRA characteristic of toxicity for lead, using the TCLP test, is 5,000 ug/L, therefore no soil tested was found to be a RCRA characteristic hazardous waste. Numerous TCLP sample results for leachable lead in soil were non-detectable. The concentration of total lead in soil was measured during the RI in the area of the IRM. Total lead in soil measured in the area of the IRM ranged from 4.1 mg/kg to 696 mg/kg. The highest concentration of total lead in soil measured during the RI was 2,890 mg/kg. This sample was obtained from one of the surface debris piles. The TAGM cleanup criteria for lead is 24.8 mg/kg.

Soil

The primary VOCs in soils at the Ash Landfill site were 1,2-dichloroethene (1,2-DCE) (maximum=79 mg/kg), trichloroethene (TCE) (maximum=540 mg/kg), and vinyl chloride (VC) (maximum=1.0 mg/kg). The highest concentrations of these compounds were measured in a two-acre area, located in the northwestern corner of the Ash Landfill, at the "Bend in the Road". The primary aromatic constituents of concern were xylene (maximum=17 mg/kg) and toluene (maximum=5.7 mg/kg). The semi volatiles of principal concern were PAHs. PAHs were measured at concentrations above the NYSDEC TAGM cleanup guidelines. The metals that were detected at elevated concentrations in soils were copper (maximum=836 mg/kg), lead (maximum=2,890 mg/kg), mercury (maximum=1.2 mg/kg) and zinc (maximum=55,700 mg/kg). The highest concentrations of metals were detected in the surface soils of the debris piles. The debris piles are small surface features and do not extend into the subsurface. The extent of the aromatics in the horizontal direction was smaller than that for the chlorinated volatile organics (approximately one-half acre). The vertical impacts extended from the land surface to 4 feet below the surface (above the water table).

Surface Water and Sediment

No volatile or semi-volatile organic compounds were detected in any of the on-site surface waters or Kendaia Creek. Kendaia Creek has been classified by NYSDEC as a Class C stream. The on-site drainage ditches and wetlands have not been classified by NYSDEC. The on-site wetlands and drainage ditches do not contain surface water throughout the entire year. Metals concentrations were also low in surface water with only iron exceeding NYSDEC surface water quality standards (6 NYCRR Subparts 701-705) in three of the six on-site locations. The concentration of iron in these three samples ranged from 8.75 mg/L to 2.08 mg/L. The NYSDEC Ambient Water Quality Criteria (AWQC) for iron in a Class C surface water body is 0.3 mg/L.

The sediments of the wetland adjacent to the "Bend in the Road" (Wetland W-B) contained elevated concentrations of 1,2-DCE (640 ug/kg). No other on-site sediment samples contained concentrations of volatile or semi-volatile organics. Metals concentrations in several sediment samples exceeded the NYSDEC Sediment Criteria guidelines. For arsenic, the NYSDEC Sediment Criteria of 5 ug/kg was exceeded at 9 of the 16 sample locations. The highest concentration of 12 ug/kg was detected at the on-site wetland SD-WB. For chromium, the NYSDEC Sediment Criteria of 26 ug/kg was exceeded at 2 of the 16 sample locations. The highest concentration of 33 ug/kg was detected at the off-site location SW-600. For copper, the NYSDEC Sediment Criteria of 19 ug/kg was exceeded at 15 of the 16 sample locations. The highest concentration of 59 ug/kg was detected at SW-100. For iron, the NYSDEC Sediment Criteria of 24,000 ug/kg was exceeded at 10 of the 16 sample locations. The highest concentration of 36,800 ug/kg was detected at the off-site location SW-800. For lead, the NYSDEC Sediment Criteria of 27 ug/kg was exceeded at 9 of the 16 sample locations. The highest concentration of 219 ug/kg was detected at the off-site location SW-600. For manganese, the NYSDEC Sediment Criteria of 428 ug/kg was exceeded at 10 of the 16 sample locations. The highest concentration of 1,050 ug/kg was detected at the off-site location SW-800. For mercury, the NYSDEC Sediment Criteria of 0.11 ug/kg was exceeded at 4 of the 16 sample locations. The highest concentration of 0.81 ug/kg was detected at location SD-WE. For nickel, the NYSDEC Sediment Criteria of 22 ug/kg was exceeded at 10 of the 16 sample locations. The highest concentration of 46 ug/kg was detected at SD-WF. For zinc, the NYSDEC Sediment Criteria of 85 ug/kg was exceeded at 15 of the 16 sample locations. The highest concentration of 834 ug/kg was detected at the on-site wetland SD-WB.

Groundwater

The primary impact to the groundwater is a plume containing dissolved concentrations of TCE, 1,2-DCE, and VC that originated in the "Bend in the Road" area near the western edge of the Ash Landfill. Quarterly monitoring in 1996, 1997 and 1998 detected 1,2-DCE between 0.2 ug/L and 2 ug/L at monitoring well MW-56, which is 225 feet past the depot boundary. The most recent sampling of MW-56 in January 2000 did not detect 1,2-DCE above the detection limit of 1 ug/L. The NYSDEC GA groundwater quality standard for 1,2-DCE is 5 ug/L. It is likely that the boundary of the plume extends westward to slightly beyond the depot boundary. Exceedances over the NYSDEC GA groundwater standard, beyond the depot boundary, have not been observed. **Table 5** lists the total chlorinated ethane concentrations for four sampling rounds in the site wells.

The maximum volatile organics concentration was detected in monitoring well MW-44, located within the area considered to be the source area prior to the soil removal action. In November 1993, the concentrations of TCE, 1,2-DCE and VC were 51,000, 130,000, and 23,000 ug/l, respectively, for a total chlorinated ethene concentration of 204,000 ug/l in MW-44. The nearest exposure points for groundwater are the three farmhouse wells, located approximately 1250 feet from the leading edge of the plume. At least one of the farmhouse wells draws water from the till/weathered shale aquifer and the remaining two wells derive water from the bedrock aquifer. Vertically, the plume is believed to be restricted to the upper till/weathered shale aquifer and is not present in the deeper competent shale aquifer.

Although exceedances of the NYSDEC Class GA groundwater standards were observed in several wells during the RI for the metals chromium, lead, nickel, zinc, antimony, barium beryllium and copper, the data appears to be related to the turbidity of the sample. It was noted that wells with high turbidity have high metals concentrations. Subsequent improvements to the sampling techniques provided less turbid samples with a corresponding decrease in the concentration of metals. For example, lead in MW-44, with a turbidity of 100 NTU was measured during the second round of the RI was 147 ug/L, which was above both the EPA criteria of 15 ug/L and the NYSDEC GA standard of 25 ug/L. During the quarterly sampling conducted following the RI, the concentration of lead in MW-44 was non-detectable at less than 2 ug/L. This same trend was observed for other wells. During these sampling events, the EPA Region II Low Stress (low flow) Purging and Sampling Method was used to reduce the turbidity in the groundwater samples. As a result, the turbidity of the samples was less than 10 NTUs. Furthermore, the locations of the exceedances did not correlate to form a continuous plume, were random, and not related to a source. This supports the contention that the exceedances were related to sample turbidity rather than a release from a point source. As a result of this data, concern over exceedances of metals in groundwater was resolved and attributed to turbidity.

Although the removal action successfully removed volatile and semi volatile organics from soil, positive affects have been observed in the groundwater concentration in the area of the removal action. For example, prior to the removal action, the concentration of total chlorinated ethenes in MW-44 was 204,000 ug/L. In October 1999, the concentration in MW-44a, the replacement well for MW-44, was 1,104 ug/L, a 99.5% reduction in concentration. **Figures 4** and **5** depict the groundwater VOC plume before and after the removal action.

SUMMARY OF SITE RISK

Based on the results of the RI, a baseline risk assessment was conducted to estimate the risks associated with current and future site conditions. The baseline risk assessment estimated the human health and ecological risk that could result from the site if no remedial action were taken.

<u>Human Health Risk Assessment</u>

The reasonable maximum human exposure was evaluated. A four-step process was used for assessing site-related human health risks for a reasonable maximum exposure scenario: *Hazard Identification* identified the contaminants of concern based on several factors such as toxicity, frequency of occurrence, and concentration. *Exposure Assessment* estimated the magnitude of actual and/or potential human exposures, the frequency and duration of these exposures, and the pathways by which humans are potentially exposed. *Toxicity Assessment* determined the types of adverse health effects associated with chemical exposures, and the relationship between magnitude of exposure (dose) and severity of adverse effects (response). *Risk Characterization* summarized and combined the outputs of the exposure and toxicity assessments to provide a quantitative assessment of site-related risks (for example, one-in-a-million excess cancer risk).

The primary constituents of concern at the Ash Landfill are VOCs (primarily chlorinated and aromatic compounds), semi volatile organics (mainly PAHs), and to a lesser degree metals, such as copper, lead, mercury, and zinc. Several compounds including xylenes, toluene and PAH compounds are known to cause cancer in laboratory animals and are suspected to be human carcinogens.

The baseline risk assessment evaluated the health effects that may result from exposure for the following four receptor groups:

1. Current off-site residents;
2. Current on-site deer hunters;
3. Future on-site construction workers, and;
4. Future on-site residents.

The following exposure pathways were considered:

1. Dermal contact to surface water in Kendaia Creek and on-site wetlands while wading (current off-site residents, future on-site residents, current on-site deer hunters);
2. Dermal contact to sediments in Kendaia Creek and on-site wetlands while wading (current off-site residents, future on-site residents, current on-site deer hunters);
3. Ingestion of groundwater from off-depot wells (current off-site residents);
4. Ingestion of groundwater from on-site wells (future on-site residents);
5. Dermal contact with groundwater from off-depot wells while showering or bathing (current off-site residents);
6. Dermal contact with groundwater from on-site wells while showering or bathing (future on-site residents);
7. Inhalation of volatile organics released from groundwater from off-depot wells while showering (current off-site residents);
8. Inhalation of volatile organics released from groundwater from on-site wells while showering (future on-site residents);
9. Inhalation of volatile organics in ambient air emitted from on-site soils and transported downwind to the depot fence line (current off-site residents);
10. Ingestion of on-site surface soils; dermal contact with on-site surface soils (future on-site residents, current on-site deer hunters, future on-site construction workers);
11. Inhalation of volatile organics in ambient air emitted from on-site soils (future on-site residents, current on-site deer hunters, future on-site construction workers).

Under current EPA guidelines, the likelihood of carcinogenic and non-carcinogenic effects due to exposure to site-related chemicals are considered separately. Non-carcinogenic risks were assessed by calculation of a Hazard Index (HI), which is an expression of the chronic daily intake of a chemical divided by its safe or Reference Dose (RfD). An HI that exceeds 1.0 indicates the potential for non-carcinogenic effects to occur. Carcinogenic risks were evaluated using a cancer Slope Factor (SF), which is a measure of the cancer-causing potential of a chemical. Slope Factors are multiplied by daily intake estimates to generate an upper-bound estimate of excess lifetime cancer risk. For known or suspected carcinogens, EPA has established an acceptable cancer risk range of 10^{-4} to 10^{-6} (one-in-ten thousand to one-in-one million).

The results of the baseline risk assessment indicate that none of the current receptors are in danger of exceeding the EPA target risk range under the current and expected receptor scenarios. The carcinogenic risk for current off-site receptors is 1.8×10^{-5} and the HI is 0.15. Groundwater sampling performed as part of this investigation, in addition to several years of quarterly groundwater monitoring, has confirmed that the current off-site residents do not exhibit an increased risk of cancer in excess of the target risk range or adverse non-carcinogenic health threats. The current receptors include site workers, occasional hunters and off-site residents. Future receptors include construction workers and on-site residents. There are no on-site residences and there is no intended future use of the site for residential purposes. The on-site residential scenario was considered as a worst case condition. Currently, there are no drinking water wells at the Ash Landfill Operable Unit. Site workers and hunters obtain drinking water from other sources, including water from the depot. The water supply for the depot is supplied by the Varick Water District, which obtains water from Lake Seneca. The off-site residences obtain water from a bedrock well. The well has been tested for several years and chlorinated ethenes have never been detected. The carcinogenic risks for the off-site receptor ingesting groundwater were found to be 6×10^{-6} which is within the EPA's target risk range. Additionally, the HI of 0.14 is less than the EPA defined non-carcinogenic HI target risk value of 1.0. The cancer risks for the on-site hunter and the on-site construction worker scenarios were 9.6×10^{-6} and 3.4×10^{-7} respectively, which are also within the EPA target ranges. The HI for these receptors were 0.0075 and 0.003 respectively, less than the EPA defined non-carcinogenic HI target risk value of 1.0

Currently, there is no evidence of concentrations of VOCs exceeding the New York State GA groundwater quality standards at the leading edge of the plume. The edge of the plume is located at the western boundary of the Ash Landfill Operable Unit. The nearest off-site exposure points for groundwater are the three farmhouse wells, located approximately 1,250 feet from the leading edge of the plume. Groundwater monitoring of these three monitoring wells for approximately eight to ten years has not indicated any VOC contamination in the water supply. The land located off-site and adjacent to the Ash Landfill is currently used as farmland and no residential future land use is currently planned. The till/weathered shale aquifer is unlikely to yield sufficient quantities of water for residential use.

The carcinogenic risks for potential future residents using groundwater for drinking at SEDA is 1.4×10^{-3}, and the HI is 3.2. Although risks exist for potential future residents using groundwater for drinking at SEDA, the Local Redevelopment Authority (LRA) does not intend to use this land for residential purposes. The future intended use for the site has been determined by the LRA is conservation/recreational area. As part of the BRAC process, the future land use has been determined by the LRA in conjunction with the Army. As of July 1996, the LRA recommended to the Army specific reuse alternatives for several areas at SEDA. Accordingly, it is unreasonable to establish remedial action objectives and remediate to conditions inconsistent with such land use. Any decisions pertaining to implementing a remedial action would be based upon the current and intended future land use. This includes the risk to the receptor groups: the current off-site residents, the current on-site hunters, the future on-site residents, current on-site hunters and the future on-site construction workers. Should the intended future land use become residential, then in accordance with U.S. Army regulations and CERCLA, the U.S. Army would notify all appropriate regulatory bodies and perform any remedial action necessary to meet the risk requirements for this land use scenario.

Ecological Risk Assessment

The reasonable maximum environmental exposure was also evaluated. A four-step process was used for assessing site-related ecological risks for a reasonable maximum exposure scenario:

- *Problem Formulation*--a qualitative evaluation of contaminant release, migration, and fate. Identification of contaminants of concern, receptors, exposure pathways, and known ecological effects of the contaminants; and selection of endpoints for further study.
- *Exposure Assessment*--a quantitative evaluation of contaminant release, migration, and fate; characterization of exposure pathways and receptors; and measurement or estimation of exposure point concentrations.
- *Ecological Effects Assessment*--literature reviews, field studies, and toxicity tests linking contaminant concentrations to effects on ecological receptors.
- *Risk Characterization*--measurement or estimation of current and future adverse effects.

Exposure to terrestrial ecological species was assumed to occur from soil within the top 2 feet of surface soil. The maximum concentration of lead in surface soil was 2,890 mg/kg. However, for the ecological risk assessment, the 95th UCL of the mean for lead in surface soils, calculated as 265 mg/kg, was used as the exposure point concentration. For cadmium, the maximum concentration in surface soil was 43.1 mg/kg. The 95th UCL of the mean for cadmium in surface soils was calculated as 5.5 mg/kg, which was used as the exposure point concentration. The maximum concentration of zinc in surface soil was 55,700 mg/kg. The 95th UCL of the mean for zinc in surface soils, calculated as 1,580 mg/kg, which was used as the exposure point concentration. The maximum concentration of the PAH compound acenaphthene in surface soil was 2.2 mg/kg. The 95th UCL of the mean for acenaphthene in surface soils, calculated as 0.538 mg/kg, which was used as the exposure point concentration.

On-site soils, surface waters and sediment suggest the site conditions may pose a slightly elevated ecological risk due to the presence of heavy metals. However, these criteria are not considered ARARs since none of these criteria are promulgated standards. The NYSDEC and Federal Ambient Water Quality Criteria (AWQC), which are promulgated standards for Kendaia Creek are considered to be ARARs. No exceedances of these AWQCs were observed for downstream samples from Kendaia Creek, classified by NYSDEC as a Class C stream. Metal exceedances were identified for ecological guidelines and reported literature values for on-site soil, sediment and surface water. The actual ecological risk caused by these exceedances is not readily observable. Furthermore, the use of the on-site wetlands and surface waters by aquatic species is unlikely since these wetlands are small and dry during a large portion of the year.

SCOPE AND ROLE OF ACTION

The scope of this action is to provide adequate protection for current and future human and ecological receptors at the Ash Landfill at SEDA. The Ash Landfill (SEAD-3, -6, -8, -14, and -15) is one of 13 areas subject to remedial investigation/feasibility study at SEDA. The other areas would be addressed separately. The 13 areas where remedial investigations/feasibility studies are conducted at the SEDA are listed in **Table 6**.

The future land use of the site is listed by the Local Redevelopment Authority (LRA) as recreational/conservation. Cleanup levels, remedial action objectives and remedial alternatives were selected consistent with this intended future land use.

REMEDIAL ACTION OBJECTIVES

Remedial action objectives have been developed that consist of media-specific objectives for the protection of human health and the environment. These objectives are based on available information and standards such as ARARs and risk-based levels established in the risk assessment. The following sections describe how these remedial objectives were determined. The remedial action objectives and site-specific cleanup goals are summarized at the end of the discussion.

Remedial action objectives are specific goals to protect human health and the environment; they specify the contaminant(s) of concern, the exposure route(s), receptor(s), and acceptable contaminant level(s) for each exposure route. These objectives are based on risk levels established in the risk assessment and comply with ARARs to the greatest extent possible. These ARARs for groundwater and for soil are listed in **Table 7**. Whenever possible, consideration was given to the NCP preference for permanent solutions. The following sections describe how these remedial objectives were determined. The remedial action objectives and site-specific cleanup goals are summarized at the end of the discussion.

Site-specific remedial action objectives were established between NYSDEC, the USEPA (Region II), and the Army for the Ash Landfill. The objectives for soil/sediment remedial action alternatives were developed to accomplish the following:

- Mitigate exposure pathways for dermal contact and ingestion of VOCs, metals and PAHs for current and intended future site use scenarios, thereby decreasing risk to human health and ecological receptors.

Development of groundwater remedial action options would accomplish the following:

- Comply with ARARs for New York State Class GA groundwater quality standards and Federal Maximum Contaminant Levels (MCLs).

- Reduce and improve non-carcinogenic and cancer risk levels for current and intended future receptors.

- Prevent exposure to off-site receptors through possible off-site migration of the VOC plume.

SUMMARY OF REMEDIAL ALTERNATIVES

CERCLA requires that each selected site remedy be protective of human health and the environment, be cost effective, comply with other statutory laws; and use permanent solutions, alternative treatment technologies, and resource recovery options to the maximum extent possible. In addition, the statute includes a preference for treatment as a principal element for the reduction of toxicity, mobility, or volume of the hazardous substances.

In the RI/FS report, remedial alternatives were divided into two categories:

Soil/sediment source control (SC)
Groundwater migration control (MC)

Source Control (SC) Remedial Alternatives

Five source control options were identified for soil/sediment contamination at the Ash Landfill. These options are:

- SC-1: The No-Action Alternative
- SC-2: Excavation of the Ash Landfill, the NCFL and the Debris Piles/Disposal in an off-site, Non-Hazardous Subtitle D landfill.
- SC-3: Excavation of Various areas of the Ash Landfill and the Debris Piles/Consolidation to the NCFL/Cap the NCFL
- SC-4: Excavation/Soil Wash/Backfill Coarse Fraction/Landfill and Solidify Fine Fraction
- SC-5: Excavation of Debris Piles at the Ash Landfill/Disposal in an Off-Site, Non-Hazardous Subtitle D landfill/Soil Cap for Ash Landfill and the NCFL

Alternative SC 1: The No-Action Alternative

The Superfund program requires that the "No-Action" option be considered as a baseline for comparison of other options. There are no costs associated with the no-action option. The no-action option means that no remedial activities would be undertaken at the site. No monitoring or security measures would be undertaken. Any attenuation of the threats posed by the site to human health and the environment would be the result of natural processes. Current security measures would be eliminated or modified so that the property may be transferred or leased as appropriate.

Alternative SC-2: Excavation of the Ash Landfill, NCFL, and Debris Piles/Disposal in an Off-Site Subtitle D Landfill

Capital Cost: $17.5 million
O & M Cost: $0
Present Worth Cost: $17.5 million
Construction Time: Construction would take 12 to 18 months depending on the weather.

This option consists of excavating contaminated soils from the Ash Landfill, the NCFL, the debris piles, and consolidating them at the NCFL. The results of the RI indicate that these areas are well-defined localized areas that are less than 10 feet deep, and could be removed with standard construction equipment. The excavated materials would then be transported to an off-site Subtitle D landfill. Clean backfill materials would then be transported to the site and used to fill the excavation. A vegetative cover would be established over the backfilled area. A Subtitle D landfill refers to a solid waste landfill that meets the NYSDEC and USEPA Subtitle D landfill construction specifications.

Excavation would involve removal of approximately 45,500 cubic yards of material. Once excavated, soil and solid waste would be stockpiled and tested for the TCLP. If results indicate that the soil is above the TCLP limits for hazardous waste then the material will be treated and the soil will be disposed of in a Subtitle D landfill.

Alternative SC-2 is protective, implementable and effective for managing the constituents of concern (i.e., metals and PAHs) that remain following the elimination of the VOCs. This alternative is considered to be the best for long-term protectiveness since none of the constituents of concern would remain on-site. However, from the perspective of short-term protectiveness, this alternative would not be ranked high due to the impacts to nearby residents and on-site workers from truck traffic and dust. Ecological receptors would be impacted during the construction phase. Maintenance and monitoring would not be required since all the materials would have been removed. Since this alternative also involves transferring waste from one landfill to another, there will be a decrease in available landfill space. Landfills are used by several municipalities for management of solid waste.

Alternative SC-3: Excavation of the Ash Landfill and Debris Piles/Consolidation at the NCFL/Cap the NCFL

Capital Cost: $1.4 million
O & M Cost: $490,000
Present Worth Cost: $1.89 million
Construction Time: Construction would take 4 to 6 months depending on the weather.

This option consists of excavating contaminated soils from the Ash Landfill area, the "Bend-in-the-Road" area, the debris piles; and consolidating them at the NCFL. The residual materials from the non-time critical removal action would be used as replacement fill material. Due to the NCFL's current use and proximity to the other areas, it is an ideal on-site area to consolidate the non-volatile waste material. Because the soils at the "Bend-in-the-Road" have been remediated, no volatile organic contaminated source soils exist at the site, and the most likely exposure pathway is from dermal contact or ingestion of soils impacted with heavy metal constituents. Isolating these materials in the NCFL would prevent the potential for this type of exposure. The final cap would consist of a 12-inch thick barrier such as clay or a geomembrane, covered with a vegetative layer.

The first step in this option is excavation. An excavation plan would be developed using previous RI data to delineate the extent of removal. A wetland mitigation plan would also be developed. The maximum volume to be excavated is approximately 32,400 cubic yards, which includes all the soils except those in the NCFL. The expected depth of the excavation would be approximately 2 feet. The soils in the NCFL would remain in-place and be capped. The excavation would be accomplished with standard construction equipment, such as a front-end loader or bulldozer. The excavated soil would be immediately transported to the NCFL where it would be consolidated and eventually capped.

There are also areas at the site, such as the debris piles, the refuse burning pits, and the Ash Landfill, that contain elevated concentrations of heavy metals, pesticides, and PAHs. Although leaching and migration into groundwater are not currently occurring, erosion and overland transport could be a potential transport mechanism. Alternative SC-3 would mitigate this concern.

Alternative SC-3 is effective, implementable, and would be relatively cost effective for managing the constituents of concern (metals and PAHs) that remain following the elimination of the VOCs. Because the constituents of concern remain on-site, capping is a necessary technology requiring future maintenance and monitoring to ensure the stability of the landfill, prevent runoff or erosion of the landfill contents, and prevent leaching of the constituents of concern to groundwater.

Because this option would result in contaminants remaining on-site, CERCLA requires that the site be reviewed every five years. If justified by the review, remedial actions may be implemented to remove or treat the wastes.

Alternative SC-4: Excavation of the Ash Landfill, the NCFL and the Debris Piles/Soil Washing/Backfill Coarse Fraction/Solidify Fine Fraction/Cap

Capital Cost: $31.5 M
O & M Cost: $490,000
Present Worth Cost: $32 M
Construction Time: Construction would take 3 to 6 months.

The SC-4 option involves five unit operations: excavation, soil washing, backfilling of the coarse fraction, solidification of the fine fraction, and capping. The volume to be processed for this option is approximately 68,700 yd^3.

For this option, the sediments and soils would be excavated and processed to segregate the coarse fraction of soil from the fine fraction. Due to the increased surface area, fine particles tend to accumulate constituents of concern greater than other size fractions, but are also more difficult to clean. By segregating the fine particles from the coarse soil particles, the majority of the impacted soil would be removed The coarse fraction would then be backfilled as clean fill, providing the Remedial Action Objectives are met. Fine particles would be treated through solidification.

Acid leaching and biological treatment of the fine particles was also investigated for this option, minimizing the volume of soil that would require off-site disposal. Soil washing is an effective alternative, due to the high percentage of fines at the Ash Landfill (30 to 70%). The success of acid leaching is improbable since the concentrations of the metals are not high enough to warrant this aggressive process. The added cost and safety issues associated with using acid are also negative factors. The efficiency of removing the organic contaminants with acid is also of concern and it is likely that many organic contaminants would remain with the acid extracted soil. For these reasons, acid extraction was not considered further.

Segregated fines can be biologically treated using a slurry reactor. This process is specific for degradation of the organic portion of the washed fine fraction but would have little effect on the heavy metal constituents. Due to the difficulties associated with washing a soil matrix composed primarily of fines, with organic and inorganic contamination, this unit operation was not considered further.

The more attractive option would be to render the segregated fine soil particles non-reactive by solidification. Solidification/stabilization is a process converting components to less toxic, mobile, and/or insoluble forms. The primary goals of solidification are to improve the handling and physical characteristics of the waste, decrease the solubility and mobility of soil metals, and decrease the surface area of the soil matrix. The physical properties of the soil or waste are not necessarily changed by this process (EPA 1990). Solidification of inorganic constituents is achieved with cement or pozzolanic additives. Organic solidification/stabilization is often accomplished with thermo-plastic or organic polymerization additives (EPA, 1989). For soils containing both organic and inorganic contaminants, a combination of these processes can be used.

Solidification/stabilization has been used primarily for the treatment of soils containing inorganic contaminants and has been shown to be effective for heavy metals. If organics are present in large concentrations (such as in oily wastes) the setting process may be adversely affected, and may not bind up in the finished product. Although the soil from the Ash Landfill does contain organic contaminants, the concentrations are not expected to cause solidification problems. Bench-scale treatability tests would be conducted to assess the adequacy of a given additive to a specific soil mixture. Cement-based stabilization is the likely choice for the Ash Landfill. Portland Cement is a typical solidification technology.

The coarse fraction of the soils that exceed the Toxicity Characteristic Leaching Procedure (TCLP) requirements would also be solidified prior to land filling in the NCFL. Coarse soils that do not exceed TCLP requirements would be backfilled on-site.

Solidification/stabilization can be conducted either in-situ or in a batch mode. For in-situ solidification/stabilization, the mixtures are injected into the soil and then mixed. In batch operations, the material is removed from the ground with standard earthmoving equipment and mixed in units such as standard cement trucks. Batch processes require more area than in-situ processes because space is necessary to store the untreated soil when it is removed from the ground. At the Ash Landfill, a batch operation would be used. The contaminated soil is shallow, and is easily removed. In addition, there is plenty of space available to set up a stockpile area and cement plant. The solidified soil/additive matrix would prevent leaching of these residual materials through both chemical and physical barriers. The chemical barrier is due to the insoluble forms that metals will be created when mixed with the soil/additive matrix. This mass would then be land filled on the site in the location from where the excavation was originally performed and capped to further reduce adverse effects of long term exposure.

This process decreases constituent mobility by binding constituents into a leach-resistant, concrete-like matrix while increasing the waste material volume by approximately 50%. Solidification is expected to be completed at 75 ton/hour (tph) or about 50 cy/hr.

Alternative SC-5: Excavation of Debris Piles/Disposal in an Off-Site, Non-Hazardous Subtitle D Landfill/Vegetative Cover over Ash Landfill and NCFL

Capital Cost: $237,000
30-Year O & M Cost: $490,000 (maintenance of cover)
Present Worth Cost: $727,000
Construction Time: Construction would take 4 to 6 months depending on the weather.

This option consists of excavating soils from the debris piles and transporting the soil to an off-site landfill. The rationale for this option is that the debris piles represent the areas with the highest concentrations of metals and PAHs. The removal of these piles represents an approach that is effective, easily implementable and cost-effective. Off-site disposal at a Subtitle D landfill eliminates any threat that these constituents may pose at the Ash Landfill site. Excavation, hauling, and disposal are proven and readily available remedial technologies. Selective excavation of the debris piles would effectively remove the highest concentrations of metals and PAHs at the site and essentially lower the risk levels associated with on-site soils.

An excavation plan would be developed using previous RI data to delineate the extent of removal. This plan would include a wetland mitigation plan that would provide protection of the existing wetlands. The maximum volume to be excavated is approximately 770 cubic yards, which includes all the soils associated with the debris piles. The soils in the NCFL and the Ash Landfill would remain in-place and be covered with a vegetative soil cover of 12 inches. The excavation would be accomplished with standard construction equipment. The excavated soil would be temporarily stockpiled in a secure area, tested for disposal requirements, and disposed of off-site in a secure, non-hazardous waste, Subtitle D landfill assuming that the soils meet the criteria for disposal. If testing indicates that the soils are not suitable for disposal in a Subtitle D landfill, then other options such as disposal in a Subtitle C landfill would be considered.

Migration Control Alternatives

The FS report evaluates in detail seven remedial options for addressing the contamination associated with migration control at the Ash Landfill. These options are:

- MC-1: The No-Action Alternative
- MC-2: Natural Attenuation and Degradation of Plume/Institutional Controls/Alternative Water Supply
- MC-3/3a: Air Sparging of Plume/In-Situ Treatment Using Zero Valence Iron
- MC-4: Interceptor Trenches/Tank Storage/Filtration/Liquid-Phase Activated Carbon/Discharge to Surface Water
- MC-5: Interceptor Trenches/Tank Storage/Filtration/Air Stripping/Discharge to Surface Water
- MC-6: Interceptor Trenches/Tank Storage/Filtration/UV Oxidation/Discharge to Surface Water
- MC-7: Interceptor Trenches/Tank Storage/Filtration/Two-Stage Biological Treatment/Discharge to Surface Water

Alternative MC-1: No-Action

The Superfund program requires that the "No-Action" alternative be considered as a baseline for comparison of other options. There are no costs associated with the No-Action option. The No-Action option means that no remedial activities would be undertaken at the site. No monitoring or security measures would be undertaken. Any attenuation of the threats posed by the site to human health and the environment would be the result of natural processes. Current security measures would be eliminated or modified depending upon if the property is transferred or leased. The future land use of the Ash Landfill Operable Unit has been determined by the LRA as conservation/recreational. Access to the Ash Landfill could be limited depending upon the requirement of the LRA. The Army concurs with the future use as conservation/recreational.

Although current and intended land uses do not indicate unacceptable risks, groundwater quality standards have been exceeded. Detections of low levels of DCE in an off-site well suggest that the plume may extend as far as 225 feet beyond the SEDA property. These detections have not been confirmed in recent quarterly monitoring samples. The off-site detections of DCE have not been measured above the NYSDEC Class GA groundwater standard. Since these values are promulgated by the State of New York and the federal government, these groundwater quality requirements are considered to be ARARs and, therefore, additional measures may be required.

Alternative MC-2: Natural Attenuation with Institutional Controls and Alternative Water Supply

Capital Cost: $160,000
30-Year O & M Cost: $794,000
Total Present Worth Cost: $954,000
Construction Time: Construction should take 6 to 9 months

This option is different than the No-Action Alternative, MC-1, since MC-2 includes: installation of an alternate water supply to the off-site receptors, institutional controls and a monitoring program. Institutional controls would be included to prevent exposure to on-site groundwater due to ingestion. The groundwater monitoring program, started in 1987, would continue.

With the addition of the zero valence iron reactive barrier wall along the boundary of the Ash Landfill, off-site migration of the groundwater plume has been mitigated. Under this alternative, the remaining on-site groundwater plume would be removed via natural biological degradation and attenuation processes. Although the time for attaining cleanup goals would be extended compared to an active engineered treatment scenario, these processes would reduce the concentration of chlorinated ethenes in groundwater to the required levels. The existing barrier wall would prevent further off-site migration of the chlorinated ethenes if the natural processes cannot reduce the levels to the targeted goals.

Institutional controls for the Ash Landfill site would include a land use restriction to ensure that no drinking water wells would be constructed on-site. An alternate water supply, involving the installation of a water line, would supply drinking water to downgradient receptors. An existing water supply line is located near the former incinerator at the Ash Landfill Operable Unit. This water line is currently not in use but would be extended from SEDA, westerly, down West Smith Farm Road, to the farmhouse. Following base closure, the water supply system will be operated by the Varick Water District. This line would be installed with conventional trenching techniques, extending to below the frost line.

Option MC-2 considers natural processes sufficient to reduce the concentration levels in the plume. As an additional level of protection, institutional controls such as a deed restriction, groundwater monitoring and an alternate water supply would be implemented. NYSDEC groundwater standards for heavy metals and volatiles have been exceeded in on-site wells. Three semi volatile organic compounds exceeded Class GA groundwater standards in one well. This well and the soil and groundwater surrounding it was excavated, treated and replaced. No semi-volatiles were detected in the replacement well following the IRM. Metals in groundwater did not contribute significantly to the risk from groundwater ingestion. This option would monitor groundwater for volatile organics.

To prevent migration and protect off-site receptors, monitoring wells would be monitored along the SEDA boundary. Monitoring activities have included quarterly monitoring of over 30 wells, including private wells at the off-site Farm House and wells between the farmhouse and the SEDA boundary. The wells located between the farmhouse and the SEDA boundary have been used as sentry wells to provide an early detection warning for plume migration. No exceedances of the Class GA standards have been detected in the sentry wells. This program has been recently reduced to semi-annual monitoring program. Monitoring would continue under this option to ensure that natural attenuation was effective in reducing the groundwater concentrations on-site, and the reactive barrier wall was effective in preventing off-site migration. If the groundwater data from the monitoring program indicated a statistically significant rising trend in the concentrations of the targeted volatile organic compounds, then a contingency plan would be initiated. Depending upon the rate of degradation, groundwater modeling has suggested that the on-site concentrations could require nearly 75 to 150 years before Class GA groundwater standards are attained.

The contingency plan would include an evaluation of applicable treatment technologies. At this time, the preferred contingency treatment option for removing VOCs in groundwater is air sparging. The plan would involve installation of a line of air sparging points, placed perpendicular to the plume. The aquifer would be sparged until the concentrations of VOCs are reduced to acceptable levels.

The combination of a long-term monitoring strategy and an alternative water supply makes this an option for protecting human health. This option does not require any additional technologies to meet the remedial action objectives for the Ash Landfill site and, therefore, is easy to implement as it involves only monitoring and an alternative water supply. This is a low-cost option to meet these objectives. The long duration of treatment and the concern about operational issues associated with a dead end public water line makes this option least desirable.

Alternative MC-3: Air Sparging of Plume

Capital Cost: $668,000
30-Year O & M Cost: $1.79M
Present Worth Cost: $2.46M Construction time: Treatability testing would take 2 to 3 months. Construction and startup would take 2 to 3 months.

Option MC-3 uses an in-situ treatment process (air sparging) to achieve reduction in groundwater concentrations. In-situ air sparging is becoming a widely used technology for remediating sites contaminated by VOCs. An air sparging system would provide a cost-effective method for groundwater remediation. The advantages of in-situ air sparging are: (1) a small volume of water must be treated per unit of time, (2) groundwater is not removed from the aquifer, and (3) the process does not draw large volumes of uncontaminated water into the zone of contamination. The treatment uses the concept of air stripping to remove VOCs. Air sparging of groundwater can be conducted using interceptor trenches or air injection wells.

Combining an interceptor trench and air sparging of the plume of VOCs provides an effective in-situ remedial option. The trench allows for the efficient collection of water through which air could be injected, thus assuring sparging of the VOCs.

Air injection wells are often used instead of interceptor trenches. Wells are generally placed a few meters below the groundwater table to induce lateral spreading of air away from the injection well. As air moves through the groundwater zone, VOCs partition into the gas phase and are swept out of the groundwater zone to the vadose zone. At the same time, the oxygen in the sparged air partitions into the groundwater. The oxygen stimulates aerobic microbial degradation of contaminants. If required, sparging systems can be integrated with a vapor recovery system. Vertical wells that have been used for air sparging applications have a very limited radius of effectiveness. Because of the low permeability of the soils, standard sparging of groundwater through air injection wells would not be as effective a treatment option as the trench. Site geology is considered to be the most important design parameter. The use of vertical wells is limited to coarser grained materials because coarse soils have lower air entry pressure requirements and provide a medium for more even air distribution. This allows better mass transfer efficiencies and more effective VOC removal. Air sparging using vertical wells would not be cost effective. Even if artificial fracturing of the soils was performed on these soils, the true effectiveness and extent of the fracturing, and thus the sparging, would not be assured. For this reason, Alternative MC-3 employs air sparging trenches.

Alternative MC-3 involves installation of two air sparging trenches and two vapor extraction trenches above the sparging trenches to collect the sparged volatiles. The system consists of a sparging trench in the saturated soil and a vapor recovery trench above the sparging trench. A trench for air sparging is constructed in cohesive soils by direct excavation and backfilling with coarse gravel. Greater efficiencies using in-situ trenched air sparging can be achieved by constructing a trench perpendicular to the groundwater flow direction, so that groundwater is forced to flow through the trench. The trenches can be installed to a depth of 30 feet. Two trenches, one located just down gradient of the former source areas and the other located at the toe of the existing plume, would be installed to the top of impermeable bedrock. Horizontal piping would be used in the trench to act as air injection and vapor extraction points. The air promotes volatilization of the organic constituents in the groundwater, and also promotes aerobic biodegradation. The volatilized organics are captured by the vapor recovery wells, in much the same manner as a soil vapor extraction system. The air stream would be passed through vapor-phase carbon or some other vapor treatment technology to meet the requirements of air quality standards. Periodic groundwater monitoring would be used to assess the progress of the treatment. This option has a treatment time of up to 30 years.

Alternative MC-3a: In-situSitu Treatment using Zero Valence Iron

Capital Cost: $2.05 M
15-Year Present Worth O & M Cost: $656,000
Total 15 Year Present Worth Cost: $2.71 M
30 Year Present Worth O & M Cost: $813,000
Total 30 Year Present Worth Cost: $2.86 M
Construction time: Construction and startup should take 4 to 6 months.

Alternative MC-3a involves a modification of MC-3. Alternative MC-3a involves destruction of chlorinated organic compounds, in situ, via a chemical reaction with a reactive zero valence iron wall. Reactive iron filings have been demonstrated to be effective in treating chlorinated solvents. The reaction chemistry involves the simultaneous oxidative corrosion of the reactive iron metal by both water and reductive dechlorination of the chlorinated compounds. Alternative MC-3a has advantages over using air to remove volatile chlorinated organics from groundwater because there is no need to recover and remove organics from the sparged air. Alternative MC-3a involves using zero valence iron, placed in direct contact with dissolved chlorinated organics in the groundwater. Alternative MC-3a will continuously treat groundwater, regardless of the thickness of the aquifer, and will require minimal operation and maintenance costs.

The feasibility study considered two trenches, described in Alternative MC-3. The trenches, arranged perpendicular to groundwater flow, were considered to function in a funnel and gate configuration. This configuration involved installing an impermeable cut-off wall (funnel), along the trench wall, that would be used to divert groundwater flow to an in situ reaction zone (gate). Reactive iron would be placed into the gate. Chlorinated organics would be destroyed as the dissolved organics passed through the reactive zone (gate). Under the original configuration, four gates would be located in each wall. Granular iron mixed with sand would be placed within the gate. The primary factors affecting the capital costs for this system were the plume dimension, the upgradient VOC concentrations and the groundwater velocity. The thickness of the reactive zone is critical to ensure sufficient treatment. The thickness of the reactive zone, and therefore the residence treatment time, can be determined by knowing the groundwater velocity and the degradation rates that are obtained from either modeling or bench-scale testing. Residence times can vary from 5-50 hours for chlorinated solvents such as trichloroethene, vinyl chloride and cis1,2-dichloroethene

Another variation of this configuration is as a continuous reactive barrier wall. In this configuration, the trench is backfilled with a mixture of reactive iron and sand. As groundwater flows through the trench, the zero valence iron chemically destroys chlorinated organics. This configuration produces less hydraulic mounding of groundwater than the funnel and gate configuration because there is no restriction of groundwater flow. At the Ash Landfill Operable Unit, groundwater mounding was identified as a potential problem that could lead to breakout of groundwater at the ground surface.

The feasibility study assumed that Alternative MC-3a would involve two trenches, configured as a funnel and gate. The feasibility study assumed that the time for treatment of the plume was 10 years.

Following the feasibility study, Alternative MC-3a was identified as a promising alternative but was considered innovative and unproven. However, since treatment was in-situ, did not require operation of an aboveground treatment plant, would operate continuously and required minimal maintenance, a demonstration study was authorized to determine the effectiveness of this emerging technology and obtain additional constructability and costing data.

The Army selected to pursue a zero valence iron demonstration study for a continuous permeable trench, instead of a funnel and gate configuration due to the concern over groundwater mounding. Using VOC concentrations and groundwater velocities obtained from the RI and degradation rates obtained from vendor modeling, the required residence time that the groundwater must be in contact with the iron was determined. The required thickness of the reactive zone was determined to be 14 inches. A residence time of 1.25 day was estimated to be sufficient for destruction of the chlorinated solvents such as TCE, vinyl chloride, and cis-1,2-dichloroethene.

The demonstration study has been ongoing since December 1998 when a 650-foot long permeable reactive wall was installed near the depot fenceline at the downgradient portion of the dissolved chlorinated organic plume. The trench bottom was placed into the competent bedrock to avoid short-circuiting of groundwater. The trench width was 14 inches and was backfilled with a 50-50 mixture of zero valence iron and imported clean sand. The final depth of the trench was between 7 to 12 feet below ground surface. In addition, a total of eleven monitoring wells were installed upgradient, in the trench and downgradient of the trench and at both ends of the trench to monitor the effectiveness of the technology. Groundwater monitoring of the reactive barrier wall has been ongoing for one year. Although some breakthrough of cis-1,2-DCE was observed, TCE was consistently degraded by the wall below the detection limit of 1 ug/l confirming the effectiveness of the treatment technology. The design of the three walls for Alternative MC-3a will be developed using a more conservative approach than the design of the existing reactive wall. The conservative approach is based on the complex hydraulics and inconsistent degradation half-lives encountered during the treatability study with zero valent iron continuous reactive wall.

During the demonstration study, groundwater modeling was also performed to further refine the estimated treatment time for the aquifer to reach the Class GA groundwater standards and Federal MCL target concentrations. With only one reactive wall in-place at the boundary of the site, the length of treatment time was estimated to be as long as 60 years. The 60-year compliance time was based upon the slow process of diffusion of chlorinated ethenes from the soil as the limiting factor. The goal for treatment was to obtain compliance in a quicker timeframe, approximately 10 to 15 years. The length of treatment time is dependent upon the number of reactive barrier walls. In order to achieve compliance in 15 years, it was estimated that two additional trenches would be required, located upgradient of the existing boundary wall. (**Figure 6**) A third continuous reactive wall (Compliance Wall on **Figure 6**) may be required to control movement of chlorinated ethenes past the existing boundary trench, that was installed during the demonstration study.

Alternative MC-3a in this PRAP is the same as Alternative 2 developed in the Draft Feasibility Memorandum for Groundwater Remediation Alternatives using Zero Valence Iron Continuous Reactive Wall at the Ash Landfill (Parsons, August 2000). This report presents a conceptual design based on the results and conclusions of the demonstration study for the reactive iron wall and the groundwater and transport modeling of different treatment wall configurations. Alternative 2 in this report included the excavation and filling of three trenches with 100% iron filings. **Figure 6** depicts the location of the existing reactive wall and the additional three proposed reactive walls: One wall would be installed about 300 ft east of the boundary wall (Middle Wall), the second one would be installed close to the former source area of the plume (Source Wall), and the third one would be installed downgradient from the existing wall, on the furthest point of the Army property, past the fenceline (Compliance Wall).

The costs for Alternative 3a in this PRAP were developed in the Feasibility Memorandum for Groundwater Remediation Alternatives using Zero Valence Iron Continuous Reactive Wall at the Ash Landfill (Parsons, August 2000). These costs were updated based on information collected after completion of the FS. The costs in the Feasibility Memorandum were developed assuming compliance in 15 years as indicated by the groundwater modeling study. However, for comparison purposes, the O&M cost was expanded to 30 years, so that the O&M period for all alternatives in this PRAP is 30 years. The 15-year cost developed in the Feasibility Memorandum and the 30-year comparative cost are presented above.

Alternative MC-4: Interceptor Trenches/Tank Storage/Filtration/Liquid-Phase Activated Carbon /Discharge to Surface Water

MC-4 was not considered further in the detailed analysis because activated carbon is not considered to be effective for vinyl chloride treatment.

Alternative MC-5: Interceptor Trenches/Tank Storage/Filtration/Air Stripping/Discharge to Surface Water

Capital Cost: **$543,000**
30-Year Present Worth O & M Cost: **$1.2 million**
Total Present Worth Cost: **$1.8 million**
Construction Time: Treatability testing would take 2 to 3 months. Construction and startup would take 2 to 4 months.

The MC-5 alternative consists of diverting the impacted groundwater from interceptor trenches to an aboveground treatment system employing an air stripping unit. This option is easily implementable and proven to be effective for removing dissolved VOCs in water. Option MC-5 uses what is commonly referred to as a "pump-and-treat" method of decontaminating groundwater.

One interceptor trench would be located as close as possible to the fence which runs along the western boundary of SEDA. This trench would prevent off-site migration of the plume. The other trench would be located in the middle of the plume, and constructed in a "V" shape, with a collection sump in the bottom of the "V." Each trench would be approximately 1000 feet long by 3 feet wide by 8 feet deep. The trenches would extend from the ground surface to the competent shale bedrock. These trenches are ideal for conditions at this site since the groundwater movement is slow, i.e., less than 20 feet per year, and the aquifer thickness is small, i.e. between 2 to 6 feet depending upon the time of year.

The collection trenches would discharge to a collection sump and be pumped to an aboveground on-site treatment facility. At the treatment facility, the collected water would accumulate in a tank that functions as a flow equalizer. Flow fluctuations are expected over the year due to varying aquifer thickness. This tank would be used as a buffer to allow the subsequent treatment unit operations to operate continuously and uniformly.

Filtration would be provided to remove any collected sediment and precipitated metals. It is common for dissolved metals, especially iron, to precipitate as insoluble oxides as the dissolved oxygen content of the collected groundwater increases due to exposure with ambient air. Clogging and coating of unit processes reduces treatment effectiveness and therefore, sediment or precipitated metal oxides should be controlled via filtration.

For this option, air stripping is used as the treatment process that would reduce the concentration of dissolved chlorinated organics to the remedial action objectives, which are to meet NYSDEC Class GA groundwater quality standards and Federal MCLs. Air stripping is a common groundwater treatment process, which is effective in treating TCE, 1,2-DCE and Vinyl Chloride. Groundwater is passed through a stripping tower, where it is contacted by a countercurrent air stream. Trays or column packing are used to increase the surface area of the air/water contact area to improve the efficiencies of mass transfer operations. The organic constituents are transferred from the water to the air. Depending on the air emissions requirements, the air phase may be treated or directly discharged to the atmosphere. Air emission control technologies include: vapor- phase activated carbon, thermal oxidation or catalytic oxidation. Vapor-phase carbon can be used to treat the off-gas in order to minimize air emissions. Vapor-phase carbon is efficient in capturing TCE and heavier organics but is less efficient at capturing DCE, and lighter organics. Carbon is inefficient in capturing vinyl chloride.

Thermal oxidation is another off-gas control technology, which can be used to minimize air emissions. A thermal oxidizer works by combusting the off-gas. Thermal oxidizers are effective in treating all of the chlorinated compounds present in the Ash Landfill groundwater.

Catalytic oxidization is another off-gas treatment technology that could be considered for off-gas control. Catalytic oxidation is similar to thermal oxidation in that the organic compounds are thermally destroyed. An advantage of catalytic oxidizers over thermal oxidizers is that catalytic oxidizers operate at lower temperatures and therefore have lower operating costs. Catalytic oxidizers are effective in treating all the organics present in the site groundwater. Catalytic oxidizers may have higher O&M costs than thermal oxidizers, though the day to day operational costs are lower.

Following treatment, the effluent would be discharged to the nearby drainage ditches that exist along the sides of the patrol roads. Eventually the water drains to Kendaia Creek. In this case, the effluent would need to meet the requirements for NYSDEC Class C surface water which is the classification of Kendaia Creek. This option has a estimated treatment time of 30 years.

Alternative MC-6: Interceptor Trenches/Tank Storage/Filtration/ Hardness Removal/UV Oxidation/Liquid-Phase Carbon/Drainage Ditch Surface Water Discharge

Capital Cost: $556,000
30-Year Present Worth O & M Cost: $1.3 Million
Total Present Worth Cost: $1.9 Million
Construction Time: Treatability testing would take 2 to 3 months. Construction and startup should take 6 to 9 months.

Similar to option MC-5, this option involves collecting groundwater using interceptor trenches and pumping the collected groundwater to an on-site treatment facility. The collected groundwater receives pretreatment including flow equalization from temporary storage and filtration to remove suspended sediment and any precipitated metal oxides.

Following the pretreatment of groundwater, this option uses liquid phase chemical oxidation from hydroxyl radicals, produced from the interactions of ultraviolet (UV) radiation and hydrogen peroxide, H_2O_2. Ozone may be added if treatment effectiveness is lower than required. This treatment process is proven to be effective in achieving greater than 99 percent destruction efficiency. Generally, using metering pumps, the contaminated groundwater is mixed with peroxide, and enters the UV reaction chamber. If required, ozone is added to the reaction chamber, and hydroxyl radicals are formed. The formation of the hydroxyl radicals is catalyzed by the UV light. The hydroxyl radicals react rapidly with the chlorinated organics, generating carbon dioxide, chloride and water. If ozone is added, any ozone not reacted is decomposed in an ozone treatment unit prior to discharge.

The effluent from the UV treatment process is then discharged to the drainage ditches that exist along the edge of patrol roads. This surface water eventually will flow to Kendaia Creek. This surface water discharge would need to meet the NYSDEC Class C stream classification quality standards for Kendaia Creek. This option has an estimated treatment time of 30 years.

EVALUATION OF ALTERNATIVES

During the detailed evaluation of remedial alternatives, each alternative is assessed against nine evaluation criteria, namely, overall protection of human health and the environment, compliance with applicable or relevant and appropriate requirements (ARAR)s, long-term effectiveness and permanence, reduction of toxicity, mobility, or volume, short-term effectiveness, implementability, cost, and state and community acceptance. **Table 8** provides a summary of each source control alternative and how each alternative complies with these requirements. **Table 9** provides a similar summary for each migration control alternative and how each alternative complies with these requirements.

A comparative analysis of these alternatives based upon these evaluation criteria is presented below.

Overall Protection of Human Health and the Environment

Alternative SC-1, the no-action alternative for soil, is protective of human health from exposure to soil for on-site residents, hunters and construction workers. The non-carcinogenic risks from exposure to soil, following the IRM are 0.01, 0.0075, 0.064, respectively, which are below the EPA target level of 1. The carcinogenic risks from exposure to soil, following the IRM, have been calculated as $1x10^{-5}$, $9.4x10^{-6}$, $3.7x10^{-6}$, which are within the EPA target level of $1x10^{-4}$ and $1x10^{-6}$.

In addition to risk calculation, NYSDEC also considers exceedances of TAGM guideline values as a factor in determining protectiveness for human health. Instances remain, following the IRM, where soils were found to be in exceedance of the NYSDEC TAGM guideline limits for PAH compounds and metals. Overall, these exceedances do not cause the various site risks to exceed the EPA target levels.

An ecological survey, performed during the RI, reported no observable ecological damage. Concentrations of selected metals in soil samples collected from the Ash Landfill, the debris piles and the NCFL detected levels above guideline values considered to be protective for ecological receptors from long-term exposure. Therefore, ecological receptors were considered to be at an increased risk and not protected.

Alternative MC-1, the no-action alternative, would not be protective of human health if groundwater were ingested. The non-carcinogenic risk due to ingestion of groundwater, calculated during the RI, was 3.2, which is above the EPA target value of 1. The carcinogenic risk from ingestion of groundwater, calculated during the RI is $1.4x10^{-3}$, which is also above the EPA target range of $1x10^{-4}$ and $1x10^{-6}$. The updated risk calculation from ingestion of groundwater has not been performed following the RI or the IRM but the risk would be expected to be less, since the concentrations in groundwater have decreased, in some instances almost 100-fold, as a result of the IRM.

Ingestion of groundwater would occur if residential use was permitted. However, residential use of the Ash Landfill Operable Unit is not the current or planned intended future use. The groundwater plume has migrated to beyond the SEDA boundary. At monitoring well MW-56, which is located 225 feet beyond the SEDA boundary, 1,2-DCE has been detected as high as 2 ug/L. The NYSDEC GA and Federal MCL for 1,2-DCE is 5 ug/L. This compound has not been detected in the last sampling rounds in October 1999 and January 2000.

As a means to control further migration, evaluate an innovative technology and expedite site remediation, the Army conducted an in-situ demonstration study of the zero valence iron technology. Zero valence iron has been shown to be effective in chemically destroying chlorinated ethene compounds through a process known as reductive dechlorination. In December 1998, the Army installed a 650-foot long permeable reactive barrier trench at the boundary of the depot, perpendicular to the flow of the groundwater plume and spanning the entire width of the plume. The trench extended from one foot below the ground surface to the top of the competent bedrock and was backfilled with a 50/50 mixture of clean sand and zero-valence iron. Eleven monitoring wells, three clusters of three wells, were installed immediately upgradient, within and immediately downgradient of the reactive wall with one well being added at each end of the trench. Groundwater monitoring of the trench performance went on for approximately one year. The results of the study indicated that the trench was successful in reducing the concentrations of chlorinated ethenes to non-detectable or low levels. However, there were some field evidences (such as complex hydraulics and inconsistent degradation half-life) that had to be considered in the selection of the final design parameters. This trench is associated with Alternative MC-3a.

Upgradient of the reactive barrier trench, there would be little immediate reduction in risk or in the toxicity, mobility, or volume of the contaminants. The risk assessment indicated that the majority of the site risk is due to ingestion of groundwater for on-site residents. The primary source of the groundwater impacts has been eliminated via thermal treatment during the IRM. Natural attenuation would reduce the contaminant concentrations to federal and state drinking water standards, however, this would take many years. The volume of groundwater contaminated would also not increase appreciably with time, due to the zero valence iron trenches that would prevent continued migration of contaminants. Land use restrictions would prevent on-site ingestion of groundwater. Human exposure could occur due to off-site migration of contaminated groundwater that was present downgradient beyond the trench. Groundwater modeling has indicated that the concentration of groundwater would be below NYSDEC Class GA standards and federal MCLs.

Alternative SC-2 was ranked high for long-term protectiveness, since no waste would remain on-site. However, the short-term protectiveness of this alternative was ranked the lowest, since the increased number of trucks transporting the waste would increase the risks associated with collisions, injury and dust. MC-2, the alternative water supply, affords protection of human health since an alternative potable water supply would ensure clean water to the off-site residents. Since the existing reactive barrier wall will mitigate continued off-site migration, only the groundwater beyond the reactive wall would potentially affect the downgradient receptor. Therefore, some contaminated water will likely continue to migrate into other portions of the aquifer system and increase the volume of contaminated groundwater. In Alternative MC-2, there would be minimal on-site reduction in risk and in the toxicity, mobility, or volume of the contaminants. Natural attenuation to reduce the contaminant concentrations to federal and state drinking water standards would take many years.

Alternative SC-3 was ranked moderately protective for long and short-term protectiveness. Since this alternative involves excavation, consolidation at the NCFL and capping the NCFL, truck traffic will be a concern even though traffic will be reduced compared to SC-2. Truck traffic will be a required as clean backfill and capping material will have to be transported on-site. Dust will also be a short-term concern during construction. Long-term, the risk following consolidation of soils contaminated with metals and PAHs at the NCFL would require that the cap be maintained to prevent exposure to humans and ecological receptors. This alternative is considered to be protective since exposure to metals and PAH compounds would require excavation into the landfill, which is considered unlikely.

MC-3 and MC-3a were ranked high for protectiveness, since treatment would prevent off-site migration and additional trenches would reduce on-site concentrations. Active pumping alternatives are limited in effectiveness since the groundwater fluctuates dramatically during the year, meaning that at certain times of the year the pumping system will likely be dry or minimal. Migration of contaminated groundwater beyond the trenches would be a concern for protectiveness. Modeling has shown that the concentrations will be reduced to levels that are protective by the time the groundwater reached the downgradient supply well. Monitoring will be performed to ensure that exposure is not above state and federal standards for drinking water.

Overall, Alternative SC-4, soil washing, ranks the highest for long- term protection of human health and the environment by actively treating soil on-site, thereby decreasing risks due to off-site transportation. Contamination would be concentrated by washing and treated for eventual disposal off-site. The amount of off-site disposal is the smallest for this alternative and therefore would require the least amount of trucks for transport.

Alternatives MC-5 and MC-6 were ranked equally high as MC-3 and MC-3a for protectiveness because all these alternatives remove VOC contamination from the groundwater. For Migration Control Alternatives, protectiveness is a function of capturing and preventing migration of groundwater to off-site receptors. Each of these alternatives collects groundwater through trenches located at the boundary of the site and at locations within the site; therefore, all are ranked equally high. MC-4 and MC-5 involve active removal but will not be effective during dry periods of the year. Further, these alternatives would be affected by fouling of treatment systems due to iron and hardness. If the fouling were severe then treatment would not be effective and the alternative would not be protective. MC-4 was not considered further in the detailed analysis because carbon is not considered to be effective for vinyl chloride treatment, and sufficient treatment can be expected for volatiles via MC-5 by air stripping. MC-7 was not considered in the detailed analysis of alternatives, since it was screened out due to concern over the reliability of biological treatment with intermittent flow.

Alternative SC-5 was ranked high for protectiveness, but less than SC-4, since contaminated material will remain on-site. Since this alternative would not involve minimal excavation and off-site disposal for only the debris piles. No excavation of the landfill would be required. Clean cover material would be imported to the site.

Compliance with ARARs

Federal and state maximum contaminant levels (MCLs) are chemical-specific ARARs. Federal MCLs were selected as the remedial requirements for groundwater remediation except when more stringent NYSDEC GA standards existed. Compliance with ARARs will be considered for migration control alternatives only since the IRM has treated and eliminated the source of VOCs in groundwater. There are no soil standards. NYSDEC TAGM values are guidelines, not standards. Alternatives MC-1 and MC-2 are not expected to meet chemical-specific ARARs in groundwater as neither involves active, continuous remediation methods. Natural degradation and flushing of groundwater may eventually result in achievement of ARARs. The time frame has been estimated as over 100 years. The active extraction system required under Alternatives MC-5 and 6 would provide the best possible containment system for the groundwater contaminant plume. The groundwater extraction scheme in Alternatives MC-5 and 6 would create a capture zone slightly more extensive than MC-3 or MC-3a. It would allow less contamination to migrate off-site and extract a greater volume of contamination since active pumping would be used. Additionally, removal of contaminants to achieve the MCLs in such situations is also difficult due to long-term diffusion of contamination from the glacial till. Hydrologic modeling and aquifer tests performed during the RI indicate that properly placed extraction trenches would create a capture zone but these models overestimate the time to achieve cleanup as all models cannot account for diffusional aquifer matrix effects accurately. The time frame for Alternatives MC-3, MC-5 and MC-6 to achieve compliance with chemical-specific ARARs in the glacial till aquifer are likely to be between 30 to 50 years. Alternative MC-3a is likely to stimulate natural biodegradation, since the chemical reactions in the iron wall release hydrogen, a substance that is used up in microbial dechlorination. This will decrease contaminant levels, which can be expected to significantly reduce the time to achieve ARAR compliance compared to Alternatives MC-3, MC-5 and MC-6.

Alternatives MC-5 and MC-6 include surface water discharge of treated groundwater. Discharge requirements are generally the Federal and State Ambient Water Quality Criteria. The discharge from the groundwater treatment system will be designed to meet the FAWQC and the anti-degradation limits.
Alternatives MC-5 and MC-6 are expected to achieve other ARARs including the Resource Conservation and Recovery Act (RCRA) requirements for treatment

facilities, the Department of Transportation (DOT) requirements for off.site transportation of any residual materials, and the New York Solid and Hazardous Waste Regulations and the Occupational Safety and Health Act (OSHA). In addition, the operation of the treatment system in Alternative 4 will comply with federal and state air standards.

Long- Term Effectiveness and Permanence

Alternatives SC-1, MC-1 and MC-2 would not remove or contain contaminants in the groundwater in a continuous or active manner, other than what would be removed by the reactive barrier wall that is currently in-place and operating. Contaminants would continue to migrate and increase the volume of contaminated groundwater. The no-action and alternative water supply alternatives are not considered to be effective over the long term because contaminated groundwater, other than that captured via the reactive barrier wall, remains on-site and some migration off of the property will occur. This condition currently does not affect the drinking water of off-site residents and groundwater modeling has indicated that the concentrations of contaminants will be below drinking water standards by the time the groundwater reaches these wells. These alternatives will require long-term monitoring and sampling.

Alternatives MC-3, MC-5 and MC-6 are all expected to be equal in providing long-term permanence, since each alternative will operate until the desired concentration levels are achieved. The limiting factor in achieving this goal is the rate at which contaminants can be flushed out of the soil matrix. Since the aquifer matrix is glacial till and is high in clay content, diffusion is likely to play an important role in releasing contamination from the aquifer. This means the time for cleanup is long, estimated to be approximately 45 years. MC 3a is expected to take 15 years.

Alternative SC-2 is ranked high for long-term effectiveness and permanence since all materials will be excavated and disposed of in an off-site landfill. Once in the landfill, the contaminated materials are permanently entombed. However, since this alternative does not permanently fix the contaminants and involves such large volume of soil, these wastes may not be as permanently entombed as Alternative SC-4. Therefore, although SC-2 is ranked high for permanence, Alternative SC-4 is ranked the highest for long-term effectiveness and permanence. Under this alternative, contaminants are consolidated, by soil washing, and permanently fixed by stabilization/solidification. Soil washing and stabilization/solidification technology are considered reliable. Following treatment, the stabilized waste will be disposed of in an off-site landfill. The remaining materials left on-site will be free of metals and PAHs. Therefore, this alternative is considered the best from the standpoint of permanence. Although some metals and PAH-impacted soil will remain at the site under Alternatives SC-3 and SC-5, these alternatives are expected to be generally effective in providing long-term permanence. Waste materials would be isolated within either the NCFL or where the materials currently are and covered. Providing the covers remain in-place, the waste materials will not pose a threat due to direct contact and would therefore be permanent. Since leaching is not currently occurring, both alternatives are equally permanent for long-term leaching, since the landfills have been in-place for decades without causing a concern due to leaching. Perhaps, Alternative SC-5 is somewhat more attractive, since all other alternatives, except the no-action alternative, include excavation, which could cause materials, such as metals, to become more leachable, either through interaction with other waste materials or from an increase in the surface area of the waste, following excavation and sorting.

Reduction in Toxicity. Mobility, or Volume

Alternatives MC-1, MC-2 and SC-1 would not provide for any active, continuous mechanisms for the containment, removal, treatment, or disposal of contaminated groundwater, other than what would be accomplished by the reactive barrier wall. Alternatives SC-2, SC-3, SC-5 would not reduce the toxicity, mobility or volume, as there is no treatment performed. For these alternatives, materials are either land filled or covered in-place. SC-2 would include some reduction in mobility following whatever landfill the waste was disposed in. However, there could also be an increase if materials interact with leachate produced as other waste products at the landfill decompose. Presumably, the landfill would have provisions to accumulate and handle any leachate produced; nonetheless, the possibility of migration from a large landfill that collects large amounts of waste materials has a remote possibility that a leak could occur. SC-4 would provide the greatest reduction in toxicity, mobility or volume by providing the most amount of treatment. This alternative involves reduction in volume by soil washing followed by fixation. Chemical fixation, i.e. stabilization/solidification, will decrease the toxicity by making the materials less available for biouptake and reduce the mobility through the chemical bonding that would occur during fixation. Eventually, the stabilized waste would be disposed of in an off-site landfill but the amount would be less than what would have been necessary if soil washing had not been performed. SC-5 involves the least amount of off-site land filling and therefore is the alternative that meets the goal of the NCP to minimize the amount of material that is disposed of in an off-site landfill.

Alternatives MC-3, MC-3a, MC-4 and MC-5 rely on either active pumping or passive treatment of groundwater and are dependent upon yields from the till aquifer. Therefore, these alternatives would all result in reduction in mobility and volume. However, since MC-3a and MC-6 chemically destroy the contaminant, there is a decrease in toxicity.

Short-Term Effectiveness

Providing groundwater at the site is not used for drinking water, all migration control alternatives provide limited effectiveness in the short-term. Installation of interceptor trenches or barrier trenches can be accomplished without large excavations, thereby effectively achieving contaminant reduction in the short term. However, alternatives, such as MC-4 and MC-5 that involve construction of a treatment facility, will require longer times for construction. The system will not be effective in recovering groundwater during the periods of the year when the water table is low. MC-3a is considered to be the best for short-term effectiveness, since it will require the least amount of time to be implemented and be effective and will operate during the entire year.

The source control alternatives that require excavation are also effective in the short-term. However, large excavations such as that required under SC-2 , SC-3 and SC-4 will take extended times. Alternative SC-5 can be implemented quickly and will require the shortest time to be effective.

Implementability

Excluding the no-action alternatives, MC-1 and SC-1, which will not require any effort to implement and therefore are the easiest to implement, SC-5 is ranked the highest for implementability of the source control alternatives. This is because the excavation portion of this alternative is minimal and construction of the cover over the Ash Landfill and the NCFL will involve a small amount of material to import. The cover will not be an impermeable RCRA landfill cover but will be a vegetative cover, which is easy to implement. Alternative SC-4, the soil washing alternative, was considered to be the most difficult to implement and was therefore ranked the lowest for implementability. This is because soil washing requires specialized equipment and personnel who have expertise in the technology. Although such equipment and experts are available, they are less available as opposed to local excavation contractors that can easily implement alternatives such as SC-2 and SC-3. While alternatives that involve excavation may be easy to implement from a technical sense, large excavations pose their own complexities. Complexities of the excavation alternatives include: verification and conformational testing, soil stockpile management, excavation pit dewatering, available landfill space, weather factors, dust and noise abatement, logistical truck traffic control and availability of trucks to transport a large amount of materials. Further, due to the requirements of the RCRA Land Disposal Restriction (LDR)s, conformational testing could require that excavated soil be treated to stabilize the soil prior to disposal. This would add an additional aspect of the work that would lead to difficulty in implementation.

Alternatives MC-2, MC-3 and MC-3a would be easiest to implement. Minimal effort would be required to install an alternative water line and perform the monitoring. Several of the wells to be used for monitoring already exist. Alternative MC-3a is also easily implemented, requiring installation of additional reactive barrier walls. The 650-foot long existing reactive wall at the site was installed in one week. This alternative could be implemented immediately and would be effective in reducing off-site migration and the on-site concentrations. The time required to implement Alternative MC-3a is estimated to be 6 months for design and construction. Alternatives MC-5 and MC-6 involve standard construction practices for contaminated groundwater. Alternatives MC-5 and MC-6 also involve standard construction practices and would be technically easily implementable. These alternatives were ranked lower than MC-3a because of the need to construct an aboveground treatment facility.

The extraction trench proposed under Alternatives MC-5 and MC-6 can be designed and installed relatively easily. The effectiveness of the groundwater pumping will be dependent upon the productivity of the glacial till aquifer. Information obtained during the RI indicates that it may not be possible to extract groundwater during all times of the year. In addition, the extracted groundwater is anticipated to be high in iron and alkalinity that will cause long-term performance issues.

Installation of the alternative water pipeline extension and connections is a simple engineering task, but would require coordination with local officials.

Costs

There is no capital cost associated with Alternatives SC-1 and MC-1. The capital cost for Alternative SC-2, excavation and off-site disposal of the Ash Landfill and the NCFL, is estimated to be $17,500,000. There is no annual operation and maintenance cost associated with this alternative since no residual materials would remain on-site. The capital cost for Alternative SC-3, excavation of the Ash Landfill and the Debris Piles and consolidation at the NCFL, is estimated to be $1,370,000. The 30-year present worth operation and maintenance cost is estimated to be $490,000. The total present worth cost is estimated to be $1,860,000. The capital cost for Alternative SC-4, excavation, soil washing, stabilization/solidification, is estimated to be $31,500,000. The 30-year present worth operation and maintenance cost is estimated to be $490,000. The total present worth cost for Alternative SC-4 is estimated to be $32,000,000. The capital cost for Alternative SC-5, excavation and off-site disposal of the Debris Piles/vegetative cover of the Ash Landfill and the NCFL, is estimated to be $237,000. The 30-year operation and maintenance cost is estimated to be $490,000. The total present worth cost for SC-5 is estimated to be $727,000.

The capital cost for Alternative MC-2, the alternative water supply option, is estimated to be $160,000. The 30-year present worth operation and maintenance cost is estimated to be $795,000. The total present worth cost is estimated to be $955,000. The capital cost for Alternative MC-3, air sparging of the plume, is estimated to be $668,000. The 30-year operation and maintenance cost for maintenance of the sparging system and for long-term groundwater monitoring is estimated to be $1,790,000. The interest rate used to calculate the present worth cost was 10% and the compounding period was 30 years. The total present worth cost for Alternative MC-3 is estimated to be $2,500,000. The capital cost for Alternative MC-3a, the zero valence iron reactive walls, is estimated to be $2,050,000. The 30-year operation and maintenance cost of the reactive wall system and for long-term groundwater monitoring is estimated to be $813,000. The total 30-year present worth cost for Alternative MC-3a is estimated to be $2,860,000. No capital or present worth costs have been estimated for MC-4, groundwater extraction and treatment using activated carbon, since this alternative was dropped from further consideration during the alternatives screening portion of the feasibility study. The capital cost for Alternative MC-5, groundwater extraction and treatment using air stripping is estimated to be $543,000. The 30-year operation and maintenance cost for maintenance of the air stripping system and for long-term groundwater monitoring is estimated to be $1,222,000. The interest rate used to calculate the present worth cost was 10% and the compounding period was 30 years. The total present worth cost for Alternative MC-5 is estimated to be $1,800,000. The capital cost for Alternative MC-6, groundwater extraction and treatment using UV/Ozone, is estimated to be $556,000. The 30-year operation and maintenance cost for maintenance of the sparging system and for long-term groundwater monitoring is estimated to be $1,308,000. The interest rate used to calculate the present worth cost was 10% and the compounding period was 30 years. The total present worth cost for Alternative MC-6 is estimated to be $1,900,000. No present worth costs have been calculated for MC-7, the two-stage biological treatment alternative, as this alternative was dropped from further consideration during the alternatives screening portion of the feasibility study.

State Acceptance

NYSDEC has preliminarily agreed with the preferred alternative in this PRAP.

Community Acceptance

Community acceptance for the preferred alternative will be assessed in the Record of Decision following review of the public comments received on the RI/FS report and the Proposed Plan.

Summary

A detailed alternative screening entailed an extensive ranking process of the nine evaluation criteria of overall protection of human health and the environment; compliance with applicable or relevant and appropriate requirements; long-term effectiveness and permanence; reduction of toxicity, mobility, or volume; short-term effectiveness; implementibility; cost; state acceptance; and community acceptance. Overall protection of human health and the environment and compliance with ARARs were considered threshold criteria because any option that did not meet these criteria was not considered further.

Among the Source Control Alternatives, the No-Action Alternative, SC-1, was retained as a baseline for comparison to other alternatives but does not meet the threshold criteria. The remaining options are summarized in **Table 8**.

Among the Migration Control Alternatives, Options MC-4 and MC-7 were eliminated from consideration because they did not meet threshold criteria requirements. MC-4 and MC-7 were eliminated from further consideration because these alternatives were ranked the lowest of the four pump and treat options. MC-4, the liquid phase carbon was ranked low due to the poor sorptive capacity of activated carbon to vinyl chloride and the expected fouling of the carbon beds due to iron and alkalinity. MC-7, the two-stage biological treatment option was ranked low because biological treatment systems require a continuous flow of water. The aquifer conditions at the site would likely not be able to supply sufficient flow year round. Additionally, the two-stage biological treatment technology is considered innovative and not as reliable as the other options. Operational requirements for a biological system are higher than the other options. The remaining options are summarized in **Table 9**.

PREFERRED ALTERNATIVE

Remedial action alternatives were prepared independently for source control and migration control of constituents of concern at the Ash Landfill. The success of the non-time critical removal action in removing volatile organics from on-site soils (conducted between August 1994 and June 1995) indicates that conditions at the site have improved since the RI/FS reports were prepared. The LRA has determined that the future use of this site is as a conservation/recreational area. The baseline human health risk assessment indicates that under the current and planned future use of the site, the carcinogenic and noncarcinogenic human health risk values are all within the EPA target ranges. If risk-based health criteria are applied to the Ash Landfill, remedial objectives have been met and no further remedial actions are required. This action represents the most cost-effective means for ensuring protection of human health and the environment.

Based on an evaluation of the various options, the U.S. Army recommends Alternative SC-5. This alternative includes excavation and off-site disposal of the debris piles, establishment and maintenance of a vegetative soil cover for the Ash Landfill and the NCFL for source control, and installation of three in-situ permeable reactive barrier walls filled with 100% zero valence iron (MC-3a) for migration control of the groundwater plume as the preferred remedy for the site.

Alternative SC-5 was selected as the preferred source control alternative because the vegetative cover will be an effective barrier against exposure and is therefore one of the highest ranked alternatives for protectiveness to human and ecological receptors. The alternative minimizes the negative short-term effects, such as truck traffic and dust problems, that a large excavation would cause. SC-5 will be compliant with all ARARs. This alternative also minimizes the amount of off-site land filling that will be required. SC-5 is the easiest to implement and has the lowest cost.

Alternative, MC-3a, was selected as the preferred management of migration alternative because it will achieve substantial risk reduction by chemically destroying the dissolved chlorinated ethene compounds in groundwater. This alternative is effective in achieving these reductions. The alternative will be protective of human health and the environment by preventing off-site migration of the VOC plume. Monitoring of the plume will ensure that downgradient receptors are protected. The monitoring plan will provide adequate warning should monitoring data indicate that the plume is threatening the drinking water supply.

Since this alternative will result in contaminants remaining at the site which exceed levels which allow unlimited use and unrestricted exposure, institutional controls and five-year reviews will be required. Institutional controls will consist of deed restrictions to prevent future owners from ingesting site groundwater and disturbing the landfill cap. The five-year reviews are intended to evaluate whether the response actions remain protective of public health and the environment and will consist of document review, ARAR review, interviews, inspection/technology review and reporting,

A contingency plan will be developed as part of this preferred alternative. The contingency plan will include additional monitoring and air sparging, as necessary. Following installation of the reactive walls, groundwater from monitoring well MW-56 (see **Figure 2** for location) will be analyzed and the VOC results will be compared to the Class GA groundwater standards (trigger criteria). If a statistical analysis of the data for this well shows exceedances of Class GA standards, additional remedial action will be required. Temporary wells will be installed in the vicinity of MW-56, and the results will be used to develop an approach for air sparging. A description of the air sparging process is summarized in Alternative MC-3. If concentrations at MW-56 continue to exceed the trigger values following air sparging, an activated carbon system for the farmhouse water supply system will be installed or public water will be delivered to the house. More extensive air sparging will be performed until trigger values are no longer exceeded.

GLOSSARY

Aquifer
An aquifer is an underground rock formation through another composed of such materials as sand, soil, or gravel that can store groundwater and supply it to wells.

Adsorption
Adsorption is the adhesion of molecules of gas, liquid, or dissolved solids to a surface. The term also refers to a method of treating wastes in which activated carbon removes organic matter from wastewater.

Aromatics
Aromatics are organic compounds that contain 6-carbon ring structures, such as creosote, toluene, and phenol, that often are found at dry cleaning and electronic assembly sites.

Air Sparging
In air sparging, air is injected into the ground below a contaminated area, forming bubbles that rise and carry trapped and dissolved contaminants to the surface where they are captured by a soil vapor extraction system. Air sparging may be a good choice of treatment technology at sites contaminated with solvents and other VOCs. *See also Soil Vapor Extraction and Volatile Organic Compound.*

Air Stripping
Air stripping is a treatment system that removes or " strips" VOCs from contaminated groundwater or surface water as air is forced through the water, causing the compounds to evaporate. *See also Volatile Organic Compound.*

Applicable or Relevant and Appropriate Requirement (ARAR)
As defined under CERCLA, ARARs are cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limits set forth under federal or state law that specifically address problems or situations present at a CERCLA site. ARARs are major considerations in setting cleanup goals, selecting a remedy, and determining how to implement that remedy at a CERCLA site. ARARs must be attained at all CERCLA sites unless a waiver is attained. ARARs are not national cleanup standards for the Superfund program. *See also Comprehensive Environmental Response, Compensation, and Liability Act and Superfund.*

Army Corps of Engineer (USACOE)
The engineering organization of the U.S. Army. The districts involved in the Seneca Army Depot Activity project includes: the New York District (CENAN), the New England District (CENED), the Huntsville Center for Engineering Support (CEHNC).

Base Realignment and Closure (BRAC)
A congressionally mandated process that involves closure of military bases. The goal of BRAC is to transition the former bases from military uses to civilian reuse, with the intent of minimizing the negative effects of base closure by spurring economic development and growth. The SEDA was listed as a base to be closed in October, 1995. Base closure is in the process of being performed.

Baseline Risk Assessment
A baseline risk assessment is an assessment conducted before cleanup activities begin at a site to identify and evaluate the threat to human health and the environment. After remediation has been completed, the information obtained during a baseline risk assessment can be used to determine whether the cleanup levels were reached.

Bedrock
Bedrock is the rock that underlies the soil; it can be permeable or non-permeable. The underlying bedrock as the Seneca Army Depot Activity is shale. *See also Confining Layer.*

Bioremediation
Bioremediation refers to treatment processes that use microorganisms (usually naturally occurring) such as bacteria, yeast, or fungi to break down hazardous substances into less toxic or nontoxic substances. Bioremediation can be used to clean up contaminated soil and water. In-situ bioremediation treats the contaminated soil or groundwater in the location in which it is found. For ex situ bioremediation processes, contaminated soil must be excavated or groundwater pumped to the surface before they can be treated.

Borehole
A borehole is a hole cut into the ground by means of a drilling rig.

Borehole Geophysics
Borehole geophysics are nuclear or electric technologies used to identify the physical characteristics of geologic formations that are intersected by a borehole.

BTEX
BTEX is the term used for benzene, toluene, ethylbenzene, and xylene-volatile aromatic compounds typically found ill petroleum products, such as gasoline and diesel fuel.

Cadmium
Cadmium is a heavy metal that accumulates in the environment. *See also Heavy Metal.*

Cancer Slope Factor
The slope factor is a plausible upper-bound estimate of the probability of a response per unit intake of a chemical over a lifetime. The slope factor is used in risk assessments to estimate an upper-bond lifetime probability of an individual developing cancer as a result

of exposure to a particular level of a potential carcinogen. Slope factors for each chemical are expressed in units of inverse mg chemical per kg body weight per day of exposure.

Capital Cost
The initial cost associated with constructing a treatment remedy. The capital cost does not include the operation and maintenance of the remedy.

Carbon Adsorption
Carbon adsorption is a treatment system that removes contaminants from groundwater or surface water as the water is forced through tanks containing activated carbon.

Chlorinated Ethenes
A group of volatile chlorinated organic compounds that includes tetrachloroethene, trichloroethene, dichloroethene and vinyl chloride. These compounds have been detected at the Ash Landfill Operable Unit.

Cleanup
Cleanup is the term used for actions taken to deal with a release or threat of release of a hazardous substance that could affect humans and or the environment. The term sometimes is used interchangeably with the terms remedial action, removal action, response action, or corrective action.

Clean Water Act (CWA)
CW A is a 1977 amendment to the Federal Water Pollution Control Act of 1972, which set the basic structure for regulating discharges of pollutants to U.S. waters. This law gave EPA the authority to set wastewater discharge standards on an industry-by-industry basis and to set water quality standards for all contaminants in surface waters.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
CERCLA is a federal law passed in 1980 that created a special tax that funds a trust fund, commonly known as Superfund, to be used to investigate and clean up abandoned or uncontrolled hazardous waste sites. CERCLA required for the first time that EP A step beyond its traditional regulatory role and provide response authority to clean up hazardous waste sites. EP A has primary responsibility for managing cleanup and enforcement activities authorized under CERCLA. Under the program, EP A can pay for cleanup when parties responsible for the contamination cannot be located or are unwilling or unable to perform the work, or take legal action to force parties responsible for contamination to clean up the site or reimburse the federal government for the cost of the cleanup. *See also Superfund.*

Confining Layer
A "confining layer" is a geological formation characterized by low permeability that inhibits the flow of water. *See also Bedrock and Permeability.*

Contaminant
A contaminant is any physical, chemical, biological, or radiological substance or matter present in any media at concentrations that may result in adverse effects on air, water, or soil.

Data Quality Objective (DQO)
DQOs are qualitative and quantitative statements specified to ensure that data of known and appropriate quality are obtained. The DQO process is a series of planning steps, typically conducted during site assessment and investigation, that is designed to ensure that the type, quantity, and quality of environmental data used in decision making are appropriate. The DQO process involves a logical, step-by-step procedure for determining which of the complex issues affecting a site are the most relevant to planning a site investigation before any data are collected.

Dechlorination
Dechlorination, the process used primarily to treat and destroy halogenated aromatic contaminants, is the chemical reaction that removes halogens (usually chlorine) from the primary structure of the contaminating organic chemical. Dechlorination can treat contaminated liquids, soils, sludges, and sediments, as well as halogenated organics and PCBs, pesticides, and some herbicides.

Detection Limit
The lowest concentration of a chemical that can be distinguished reliably from a zero concentration.

Dichloroethene
A group of volatile chlorinated organic compounds that include: 1,1-dichloroethene, cis 1,2-dichloroethene and trans 1,2-dichloroethene

Disposal
Disposal is the final placement or destruction of toxic, radioactive or other wastes; surplus or banned pesticides or other chemicals; polluted soils; and drums containing hazardous materials from removal actions or accidental release. Disposal may be accomplished through the use of approved secure landfills, surface impoundments, land farming, deep well injection, or ocean dumping.

Electromagnetic (EM) Geophysics
EM geophysics refers to technologies used to detect spatial (horizontal and vertical) differences in subsurface electromagnetic characteristics. The data collected provide information about subsurface environments.

Engineered Control
An engineered control, such as barriers placed between a contaminated area and the rest of a site, is a method of managing environmental and health risks. Engineered controls can be used to limit exposure pathways.

Environmental Protection Agency (EPA)
The federal regulatory agency responsible for enforcing the rules and regulations of the United States. Representatives from the EPA Region 2, which includes New York State, are involved in the review and oversight of the environmental work being conducted at the Seneca Army Depot Activity.

Environmental Risk
Environmental risk is the chance that human health or the environment will suffer harm as the result of the presence of environmental hazards.

Environmental Site Assessment (ESA)
An ESA is the process that determines whether contamination is present at a site.

Ethene/Ethane
A non-toxic chemical endpoint in the breakdown of chlorinated ethenes, where all chlorine has been removed.

Expanded Site Investigation (ESI)
An expanded investigation that typically includes media sampling and analyses. An ESI is performed following a Preliminary Site Investigation to obtain more information regarding the concentrations of pollutants at a site.

Exposure Pathway
An exposure pathway is the route of contaminants from the source of contamination to potential contact with a medium (air, soil, surface water, or groundwater) that represents a potential threat to human health or the environment. Determining whether exposure pathways exist is an essential step in conducting a baseline risk assessment. *See also Baseline Risk Assessment.*

Ex Situ
The term ex situ or "moved from its original place, means excavated or removed.

Federal Facilities Agreement (FFA) also known as the Interagency Agreement (IAG)
An agreement signed between EPA, NYSDEC and the Army that describes the process for identifying, investigating and remediating sites at the Seneca Army Depot Activity.

Filtration
Filtration is a treatment process that removes solid matter from water by passing the water through a porous medium, such as sand or a manufactured filter.

GA Groundwater Standard
A water quality standard promulgated by the NYSDEC that establishes a minimum quality of a groundwater supply that could be used as a source of drinking water.

Groundwater
Groundwater is the water flow beneath the earth's surface that fills pores between such materials as sand, soil, or gravel and that often supplies wells and springs. *See also Aquifer .*

Halogenated Organic Compound
A halogenated organic compound *is* a compound containing molecules of chlorine, bromine iodine, and fluorine. Halogenated organic compounds were used in high-voltage electrical transformers because they conducted heat well while being fire resistant and good electrical insulators. Many herbicides, pesticides, and degreasing agents are made from halogenated organic compounds.

Heavy Metal
The term heavy metal refers to a group of toxic metals including arsenic, chromium, copper, lead, mercury, silver, and zinc. Heavy metals often are present at industrial sites at which operations have included battery recycling and metal plating.

Herbicide
A herbicide is a chemical pesticide designed to control or destroy plants, weeds, or grasses.

Hydrocarbon
A hydrocarbon is an organic compound containing only hydrogen and carbon, often occurring in petroleum, natural gas, and coal

Hydrogeology
Hydrogeology is the study of groundwater, including its origin, occurrence, movement, and quality.

Information Repository
An information repository is a location in a public building that is convenient for local residents, such as a public school, city hall, or library, that contains information about a Superfund site, including technical reports and reference documents.

Inorganic Compounds includes Metals
An inorganic compound is a compound that generally does not contain carbon atoms (although carbonate and bicarbonate compounds are notable exceptions). Examples of inorganic compounds include various metals.

Innovative Technology
An innovative technology is a process that has been tested and used as a treatment for hazardous waste or other contaminated materials, but lacks a long history of full-scale use and information about its cost and how well it works sufficient to support prediction of its

performance under a variety of operating conditions. An innovative technology is one that is undergoing pilot-scale treatability studies that usually are conducted in the field or the laboratory and require installation of the technology, and provide performance, cost, and design objectives for the technology. Innovative technologies are being used under many federal and state cleanup programs to treat hazardous wastes that have been improperly released. For example, the innovative technology, reactive barrier wall, is being evaluated to manage off-site migration of contamination. *See also Emerging Technology and Established Technology.*

Ion Exchange
Ion exchange, a common method of softening water, depends on the ability of certain materials to remove and exchange ions from water. These ion exchange materials, generally composed of insoluble organic polymers, are placed in a filtering device. Water softening exchange materials remove calcium and magnesium ions, replacing them with sodium ions.

In-situ
The term in-situ, "in its original place," or" on-site", means unexcavated and unmoved. In-situ soil flushing and natural attenuation are examples of in-situ treatment methods by which contaminated sites are treated without digging up or removing the contaminants.

In-situ Soil Flushing
In-situ soil flushing is an innovative treatment technology that floods contaminated soils beneath the ground surface with a solution that moves the contaminants to an area from which they can be removed. The technology requires the drilling of injection and extraction wells on site and reduces the need for excavation, handling, or transportation of hazardous substances. Contaminants considered for treatment by in-situ soil flushing include heavy metals (such as lead, copper, and zinc), halogenated organic compounds, aromatics, and PCBs. *See also Aromatics, Halogenated Organic Compound, Heavy Metal, and Polychlorinated Biphenyl.*

Institutional Controls
An institutional control is a legal or institutional measure, which subjects a property owner to limit activities at or access to a particular property. They are used to ensure protection of human health and the environment, and to expedite property reuse. Fences, posting or warning signs, and zoning and deed restrictions are examples of institutional controls.

Integrated Risk Information System (IRIS)
IRIS is an electronic database that contains EP A's latest descriptive and quantitative regulatory information about chemical constituents. Files on chemicals maintained in IRIS contain information related to both noncarcinogenic and carcinogenic health effects.

Land Disposal Restrictions (LDR)
LDR is a RCRA program that restricts the land disposal of RCRA hazardous wastes and requires treatment to established treatment standards. LDRs may be an important ARAR for Superfund actions. *See also Applicable or Relevant and Appropriate Requirement and Resource Conservation and Recovery Act.*

Landfill
A sanitary landfill is a land disposal site for non-hazardous solid wastes at which the waste is spread in layers compacted to the smallest practical volume.

Leachate
A leachate is a contaminated liquid that results when water collects contaminants as it trickles through wastes, agricultural pesticides, or fertilizers. Leaching may occur in farming areas and landfills and may be a means of the entry of hazardous substances into soil, surface water, or groundwater.

Lead
Lead is a heavy metal that is hazardous to health if breathed or swallowed. Its use in gasoline, paints, and plumbing compounds has been sharply restricted or eliminated by federal laws and regulations. *See also Heavy Metal.*

Mass Spectrometry
Mass spectrometry is a method of chemical analysis in which the substance to be analyzed is heated and placed in a vacuum. The resulting vapor is exposed to a beam of electrons that causes ionization to occur, either of the molecules or their fragments. The ionized atoms are separated according to their mass and can be identified on that basis.

Medium
A medium is a specific environment-air , water, or soil-which is the subject of regulatory concern and activities.

Mercury
Mercury is a heavy metal that can accumulate in the environment and is highly toxic if breathed or swallowed. Mercury is found in thermometers, measuring devices, pharmaceutical and agricultural chemicals, chemical manufacturing, and electrical equipment. *See also Heavy Metal.*

Methane
Methane is a colorless, nonpoisonous, flammable gas created by anaerobic decomposition of organic compounds.

Maximum Contaminant Level (MCL)
Established under the Safe Drinking Water Act as concentrations of pollutants considered protective for drinking water.

Migration Control (MC)
This term refers to a group of alternatives that were assembled to address control of migration of contamination. Most typically these alternatives involve groundwater.

Migration Pathway
A migration pathway is a potential path or route of contaminants from the source of contamination to contact with human populations or the environment. Migration pathways include air, surface water, groundwater, and land surface. The existence and identification of all potential migration pathways must be considered during assessment and characterization of a waste site.

Monitoring Well
A monitoring well is a well drilled at a specific location on or off a hazardous waste site at which groundwater can be sampled at selected depths and studied to determine the direction of groundwater flow and the types and quantities of contaminants present in the groundwater.

National Contingency Plan (NCP)
The NCP, formally the National Oil and Hazardous Substances Contingency Plan, is the major regulatory framework that guides the Superfund response effort. The NCP is a comprehensive body of regulations that outlines a step-by-step process for implementing Superfund responses and defines the roles and responsibilities of EP A, other federal agencies, states, private parties, and the communities in response to situations in which hazardous substances are released into the environment. *See also Superfund.*

National Priorities List (NPL)
The NPL is EP A's list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial response under Superfund. Inclusion of a site on the list is based primarily on the score the site receives under the HRS. Money from Superfund can be used for cleanup only at sites that are on the NPL. EP A is required to update the NPL at least once a year. *See also Hazard Ranking System and Superfund.*

Natural Attenuation
Natural attenuation is an approach to cleanup that uses natural processes to contain the spread of contamination from chemical spills and reduce the concentrations and amounts of pollutants in contaminated soil and groundwater. Natural subsurface processes, such as dilution, volatilization, biodegradation, adsorption, and chemical reactions with subsurface materials, are allowed to reduce concentrations of contaminants to acceptable levels. An in-situ treatment method that leaves the contaminants in place while those processes occur, natural attenuation is being used to clean up petroleum contamination from LUSTs across the country.

New York State Department of Environmental Protection (NYSDEC)
The state regulatory agency responsible for enforcing the rules and regulations of New York. Representatives from the headquarters in Albany and Region 8 are involved in the review and oversight of the environmental work being conducted at the Seneca Army Depot Activity.

Nephelometric Turbidity Unit (NTU)
A measurement unit of turbidity in water. Small particles of soil particles, such as clays or silts, become suspended within a water sample and increase the turbidity of the sample. This increase in turbidity has been identified as a source of increased metals concentration in samples. This effect is especially noticeable for groundwater samples collected within the clay-rich glacial till aquifer at the SEDA.

Operable Unit (OU)
A grouping of sites into one larger entity. Sites can be grouped into an Operable Unit due to geographical proximity to each other, similar chemical hazards or for other reasons. The Ash Landfill Operable Unit is comprised of 5 sites that are all located within the 130-acre parcel.

Operation and Maintenance (O&M)
O&M refers to the activities conducted at a site, following remedial actions, to ensure that the cleanup methods are working properly. O&M activities are conducted to maintain the effectiveness of the remedy and to ensure that no new threat to human health or the environment arises. Under the Superfund program, the state or PRP assumes responsibility for O&M, which may include such activities as groundwater and air monitoring, inspection and maintenance of the treatment equipment remaining on site, and maintenance of any security measures or institutional controls.

Organic Chemical or Compound
An organic chemical or compound is a substance produced by animals or plants that contains mainly carbon, hydrogen, and oxygen.

Permeability
Permeability is a characteristic that represents a qualitative description of the relative ease with which rock, soil, or sediment will transmit a fluid (liquid or gas).

Permeable Reactive Barriers
Permeable reactive barriers, also known as passive treatment walls, are installed across the flow path of a contaminated plume, allowing the water portion of the plume to flow through the wall. These barriers allow the passage of water while prohibiting the movement of contaminants by employing such agents as zero- valent iron, chelators, sorbents, and microbes. The contaminants are either degraded or retained in a concentrated form by the barrier material.

Pesticide
A pesticide is a substance or mixture of substances intended to prevent or mitigate infestation by, or destroy or repel, any pest. Pesticides can accumulate in the food chain and or contaminate the environment if misused.

Phenols
A phenol is one of a group of organic compounds that are byproducts of petroleum refining, tanning, and textile, dye, and resin manufacturing. Low concentrations of phenols cause taste and odor problems in water; higher concentrations may be harmful to human health or the environment.

Physical Separation
Physical separation processes use different size sieves and screens to concentrate contaminants into smaller volumes. Most organic and inorganic contaminants tend to bind, either chemically or physically, to the fine fraction of the soil. Fine clay and silt particles are separated from the coarse sand and gravel soil particles to concentrate the contaminants into a smaller volume of soil that could then be further treated or disposed.

Plume
A plume is a visible or measurable emission or discharge of a contaminant from a given point of origin into any medium. The term also is used to refer to measurable and potentially harmful radiation leaking from a damaged reactor.

Polychlorinated Biphenyl (PCB)
PCBs are a group of toxic, persistent chemicals, produced by chlorination of biphenyl, that once were used in high voltage electrical transformers because they conducted heat well while being fire resistant and good electrical insulators. These contaminants typically are generated from metal degreasing, printed circuit board cleaning, gasoline, and wood preserving processes. Further sale or use of PCBs was banned in 1979.

Polynuclear Aromatic Hydrocarbon (P AH)
A PAH is a chemical compound that contains more than one fused benzene ring. They are commonly found in petroleum fuels, coal products, and tar.

Potentially Responsible Party (PRP)
A PRP is an individual or company (such as owners, operators, transporters, or generators of hazardous waste) that is potentially responsible for, or contributing to, the contamination problems at a Superfund site. Whenever possible, EP A requires PRPs, through administrative and legal actions, to clean up hazardous waste sites they have contaminated. *See also Comprehensive Environmental Response, Compensation, and Liability Act and Superfund.*

Proposed Remedial Action Plan (PRAP)
The first step in the remedy selection process. The PRAP provides information supporting the decisions of how the preferred alternative was selected. It summarizes the RI/FS process and how the alternatives comply with the requirements of the NCP and CERCLA. The PRAP is provided to the public for comment. The responses to the PRAP comments are provided in the ROD.

Preliminary Assessment and Site Inspection (PA/SI)
A PA/SI is the process of collecting and reviewing available information about a known or suspected hazardous waste site or release. The PA/SI usually includes a visit to the site.

Preliminary Site Characterization Summary Report (PSCR)
A PSCR is a summary report prepared following the first phase of RI sampling. It is intended to provide a description of the results of the sampling, identify any data gaps and provide recommendations for modifications for sampling for the second phase of RI sampling. The PSCR does not include an analysis of risk but does provide a comparison of the Phase 1 data to any standards, criteria or guidelines that may be appropriate.

Present Worth Cost Analysis
The equivalent future worth of money at the present time. By discounting all costs to a common base year, the costs for different remedial action alternative scan be compared on the basis of a single figure for each alternative. This is a calculated value that requires the length of time that the future worth will be needed and the interest rate. For example, the present worth of a long-term operation and maintenance cost of a remedy is provided in terms of the present worth. Typically, a 30-year cost is required and an interest rate of 10%.

Presumptive Remedies
Presumptive remedies are preferred technologies for common categories of CERCLA sites that have been identified through historical patterns of remedy selection and EP A's scientific and engineering evaluation of performance data on technology implementation.

Pump and Treat
Pump and treat is a general term used to describe remediation methods that involve the pumping of groundwater to the surface for treatment. It is one of the most common methods of treating polluted aquifers and groundwater.

Quality Assurance (QA)
QA is a system of management activities that ensure that a process, item, or service is of the type and quality needed by the user. QA deals with setting policy and implementing an administrative system of management controls that cover planning, implementation, and review of data collection activities. QA is an important element

of a quality system that ensures that all research design and performance, environmental monitoring and sampling, and other technical and reporting activities conducted by EPA are of the highest possible quality.

Quality Control (QC)
QC refers to scientific precautions, such as calibrations and duplications, that are necessary if data of known and adequate quality are to be acquired. QC is technical in nature and is implemented at the project level. Like QA, QC is an important element of a quality system that ensures that all research design and performance, environmental monitoring and sampling, and other technical and reporting activities conducted by EPA are of the highest possible quality.

Record of Decision (ROD)
A ROD is a legal, technical, and public document that explains which cleanup alternative will be used at a Superfund NPL site. The ROD is based on information and technical analysis generated during the remedial investigation and feasibility study (RI/FS) and consideration of public comments and community concerns. *See also Preliminary Assessment and Site Investigation and Remedial Investigation and feasability Study.*

Release
A release is any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, leaching, dumping, or disposing into the environment of a hazardous or toxic chemical or extremely hazardous substance, as defined under RCRA. *See also Resource Conservation and Recovery Act.*

Remedial Design and Remedial Action (RD/RA)
The RD/RA is the step in the Superfund cleanup process that follows the RI/FS and selection of a remedy. An RD is the preparation of engineering plans and specifications to properly and effectively implement the remedy. The RA is the actual construction or implementation of the remedy. *See also Remedial Investigation and Feasibility Study.*

Remedial Investigation and Feasibility Study (RI/FS)
The RI/FS is the step in the Superfund cleanup process that is conducted to gather sufficient information to support the selection of a site remedy that will reduce or eliminate the risks associated with contamination at the site. The RI involves site characterization -collection of data and information necessary to characterize the nature and extent of contamination at the site. The RI also determines whether the contamination presents a significant risk to human health or the environment. The FS focuses on the development of specific response alternatives for addressing contamination at a site.

Interim Removal Measure (IRM); Also known as an Interim Removal Action (IRA)
A removal action usually is a short-term effort designed to stabilize or clean up a hazardous waste site that poses an immediate threat to human health or the environment. Removal actions include removing soil contaminated with hazardous substances or security measures, such as a fence at the site. Removal actions also may be conducted to respond to accidental releases of hazardous substances. CERCLA places time and money constraints on the duration of removal actions. *See also Comprehensive Environmental Response, Compensation, and Liability Act.*

Resource Conservation and Recovery Act (RCRA)
RCRA is a federal law enacted in 1976 that established a regulatory system to track hazardous substances from their generation to their disposal. The law requires the use of safe and secure procedures in treating. transporting, storing, and disposing of hazardous substances. RCRA is designed to prevent the creation of new, uncontrolled hazardous waste sites.

Revegate
The process of replacing topsoil, seed and mulch on prepared soil to prevent wind and water erosion.

RfD
The reference dose (RfD) is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without appreciable risk of deleterious effects during a lifetime.

Risk Communication
Risk communication, the exchange of information about health or environmental risks among risk assessors, risk managers, the local community, news media and interest groups, is the process of informing members of the local community about environmental risks associated with a site and the steps that are being taken to manage those risks.

Saturated Zone
The saturated zone is the area beneath the surface of the land in which all openings are filled with water.

Sediment Criteria
Technical guidance provided by NYSDEC, the Division of Fish and Wildlife, that describes allowable sediment quality for a variety of chemicals. The values provided in this document have been adopted as screening levels for comparison to site data. Exceedances of these values provides that basis for further evaluation and decision making.

Semi-Volatile Organic Compound (SVOC)
SVOCs, composed primarily of carbon and hydrogen atoms, have boiling points greater than 2000°C. Common SVOCs include PCBs and phenol *See also Phenol and Polychlorinated Biphenyl.*

Seneca Army Depot Activity (SEDA)
A 10,000-acre military facility, constructed in 1941, located in central New York responsible for storage and

management of military commodities, including munitions. The depot is undergoing closure and will cease military operations in 2000. Environmental clean-up activities will continue until all sites have been addressed.

Significant Threat
The term refers to the level of contamination that a state would consider significant enough to warrant an action. The thresholds vary from state to state.

Soil Boring
Soil boring is a process by which a soil sample is extracted from the ground for chemical, biological, and analytical testing to determine the level of contamination present.

Soil Flushing
In soil flushing, large volumes of water, at times supplemented with treatment compounds, are applied to the soil or injected into the groundwater to raise the water table into the zone of contaminated soil. Contaminants are leached into the groundwater, and the extraction fluids are recovered from the underlying aquifer. When possible, the fluids are recycled.

Soil Gas
Soil gas consists of gaseous elements and compounds that occur in the small spaces between particles of the earth and soil. Such gases can move through or leave the soil or rock, depending on changes in pressure.

Soil Vapor Extraction (SVE)
SVE, the most frequently selected innovative treatment at Superfund sites, is a process that physically separates contaminants from soil m a vapor form by exerting a vacuum through the soil formation. SVE removes VOCs and some SVOCs from soil beneath the ground surface.

Soil Washing
Soil washing is an innovative treatment technology that uses liquids (usually water, sometimes combined with chemical additives) and a mechanical process to scrub soils, removes hazardous contaminants, and concentrates the contaminants into a smaller volume. The technology is used to treat a wide range of contaminants, such as metals, gasoline, fuel oils, and pesticides. Soil washing is a relatively low-cost alternative for separating waste and minimizing volume as necessary to facilitate subsequent treatment It is often used in combination with other treatment technologies. The technology can be brought to the site, thereby eliminating the need to transport hazardous wastes.

Solidification and Stabilization
Solidification and stabilization are the processes of removing wastewater from a waste or changing it chemically to make the waste less permeable and susceptible to transport by water. Solidification and stabilization technologies can immobilize many heavy metals, certain radionuclides, and selected organic compounds, while decreasing the surface area and permeability of many types of sludge, contaminated soils, and solid wastes.

Solid Waste Management Unit (SWMU)
A SWMU is a RCRA term used to describe a contiguous area of land on or in which where solid waste, including hazardous waste, was managed. This includes landfills, tanks, land treatment areas, spills and other areas where waste materials were handled. Identification of all SWMUs at SEDA was performed as part of the RCRA Part B Permit Application process.

Solvent
A solvent is a substance, usually liquid, that is capable of dissolving or dispersing one or more other substances.

Source Control
This term refers to a group of alternatives that were assembled to address control the source of contamination. Most typically these alternatives involve addressing soil or sludge contamination.

Subsurface
Underground; beneath the surface.

Surface Water
Surface water is all water naturally open to the atmosphere, such as rivers, lakes, reservoirs, streams, and seas.

Superfund
Superfund is the trust fund that provides for the cleanup of hazardous substances released into the environment, regardless of fault. The Superfund was established under CERCLA and subsequent amendments to CERCLA. The term Superfund also is used to refer to cleanup programs designed and conducted under CERCLA and its subsequent amendments. *See also Comprehensive Environmental Response, Compensation, and Liability Act.*

Superfund Amendment and Reauthorization Act (SARA)
SARA is the 1986 act amending CERCLA that increased the size of the Superfund trust fund and established a preference for the development and use of permanent remedies, and provided new enforcement and settlement tools. *See also Comprehensive Environmental Response, Compensation, and Liability Act.*

TCL Target Compound List
The Target Compound List is a list of organic compounds that are required to analyzed when performing analytical procedures. The list includes volatile organic compounds, semi-volatile compounds, pesticides and PCBs.

Technical Administrative Guidance Memorandum (TAGM)
TAGMs are technical guidance publications provided by NYSDEC that describes various processes and procedures recommended by NYSDEC for the investigation and remediation of hazardous waste sites. One TAGM, No. 4046, provides guideline values for soil clean-up limits at waste sites. These values have been adopted as screening levels to determine "How clean is clean".

Thermal Desorption also known as Low Temperature Thermal Desorption (LTTD)
Thermal desorption is an innovative treatment technology that heats soils contaminated with hazardous wastes to temperatures from 200 to 1,000°F so that contaminants that have low boiling points will vaporize and separate from the soil. The vaporized contaminants then are collected for further treatment or destruction, typically by an air emissions treatment system. The technology is most effective at treating VOCs, SVOCs and other organic contaminants, such as PCBs, PAHs, and pesticides. It is effective in separating organics from refining wastes, coal tar wastes, waste from wood treatment, and paint wastes. It also can separate solvents, pesticides, PCBs, dioxins, and fuel oils from contaminated soil. *See also Polyaromatic Hydrocarbon, Polychlorinated Biphenyl, semi volatile Organic Compound, and Volatile Organic Compound.*

Threshold Criteria
Criteria against which a remedial alternative is evaluated to determine if it will be further considered as an option for a given site. Screening of remedial alternatives is performed by whether the alternative will pass or fail the threshold criteria. The threshold criteria is overall protective of human health and the environment and is compliant with ARARs.

Toluene
Toluene is a colorless liquid chemical with a sweet, strong odor. It is used as a solvent in aviation gasoline and in making other chemicals, perfumes, medicines, dyes, explosives, and detergents.

Total Petroleum Hydrocarbon (TPH)
TPH refers to a measure of concentration or mass of petroleum hydrocarbon constituents present in a given amount of air, soil, or water

Toxicity
Toxicity is a quantification of the degree of danger posed by a substance to animal or plant life.

Toxicity Characteristic Leaching Procedure (TCLP)
The TCLP is a testing procedure used to identify the toxicity of wastes and is the most commonly used test for degree of mobilization offered by a solidification and stabilization process. Under this procedure, a waste is subjected to a process designed to model the leaching effects that would occur if the waste was disposed of in a RCRA Subtitle D municipal landfill. *See also Solidification and Stabilization.*

Treatability Testing / Demonstration Study
Treatability testing is a process of collecting engineering performance data that will be used for final design purposes. In many instances treatability testing is performed to demonstrate the effectiveness of an innovative technology. A demonstration study has been on-going at the Ash Landfill Operable Unit involving a zero-valence iron treatment wall.

Treatment Wall
A treatment wall is a structure installed underground to treat contaminated groundwater found at hazardous waste sites. Treatment walls, also called passive treatment walls, are put in place by constructing a trench across the flow path of contaminated groundwater and filling the trench with one of a variety of materials carefully selected for the ability to clean up specific types of contaminants. As the contaminated groundwater passes through the treatment wall, the contaminants are trapped by the treatment wall or transformed into harmless substances that flow out of the wall. The major advantage of using treatment walls is that they are passive systems that treat the contaminants in place so the property can be put to productive use while it is being cleaned up. Treatment walls are useful at some sites contaminated with chlorinated solvents and metals. A treatment wall was installed at the Ash Landfill Operable Unit.

Trichloroethylene also known as Trichloroethene (TCE)
TCE is a stable, low-boiling colorless liquid that is used as a solvent, metal degreasing agent, and in other industrial applications. It is a volatile chlorinated organic chemical.

Unsaturated Zone
The unsaturated zone is the area between the land surface and the uppermost aquifer (or saturated zone). The soils in an unsaturated zone may contain air and water.

Vadose Zone
The vadose zone is the area between the surface of the land and the surface of the water table in which the moisture content is less than the saturation point and the pressure is less than atmospheric. The openings (pore spaces) also typically contain air or other gases.

Vapor
Vapor is the gaseous phase of any substance that is liquid or solid at atmospheric temperatures and pressures. Steam is an example of a vapor.

Volatile Organic Compound (VOC)
A VOC is one of a group of carbon-containing compounds that evaporate readily at room temperature. Examples of VOCs include trichloroethane;

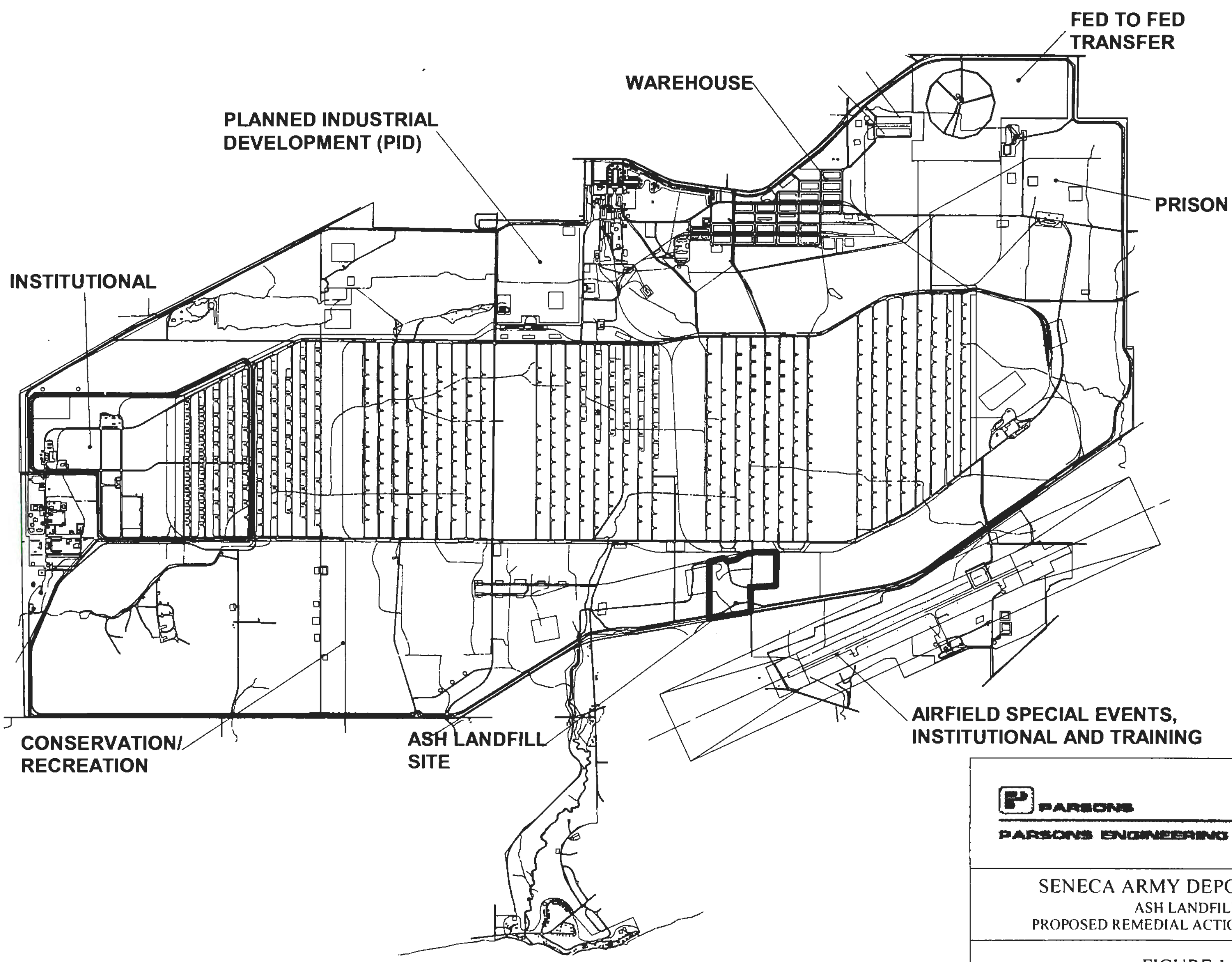
trichloroethylene; and BTEX. These contaminants typically are generated from metal degreasing, printed circuit board cleaning, gasoline, and wood preserving processes.

Volatilization
Volatilization is the process of transfer of a chemical from the aqueous or liquid phase to the gas phase. Solubility, molecular weight, and vapor pressure of the liquid and the nature of the gas-liquid affect the rate of volatilization.

Vinyl Chloride
A volatile chlorinated organic chemical, produced as a breakdown product of trichloroethene. This compound is highly volatile, being a gas a room temperature.

Wastewater
Wastewater is spent or used water from an individual home, a community, a farm, or an industry that contains dissolved or suspended matter.

Water Table
A water table is the boundary between the saturated and unsaturated zones beneath the surface of the earth, the level of groundwater, and generally is the level to which water will rise in a well *See also Aquifer and Groundwater*



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SENECA ARMY DEPOT ACTIVITY
ASH LANDFILL
PROPOSED REMEDIAL ACTION PLAN (PRAP)

FIGURE 1
ASH LANDFILL LOCATION
AND PROPOSED LAND REUSE AREAS

NOT TO SCALE	JUNE 2001

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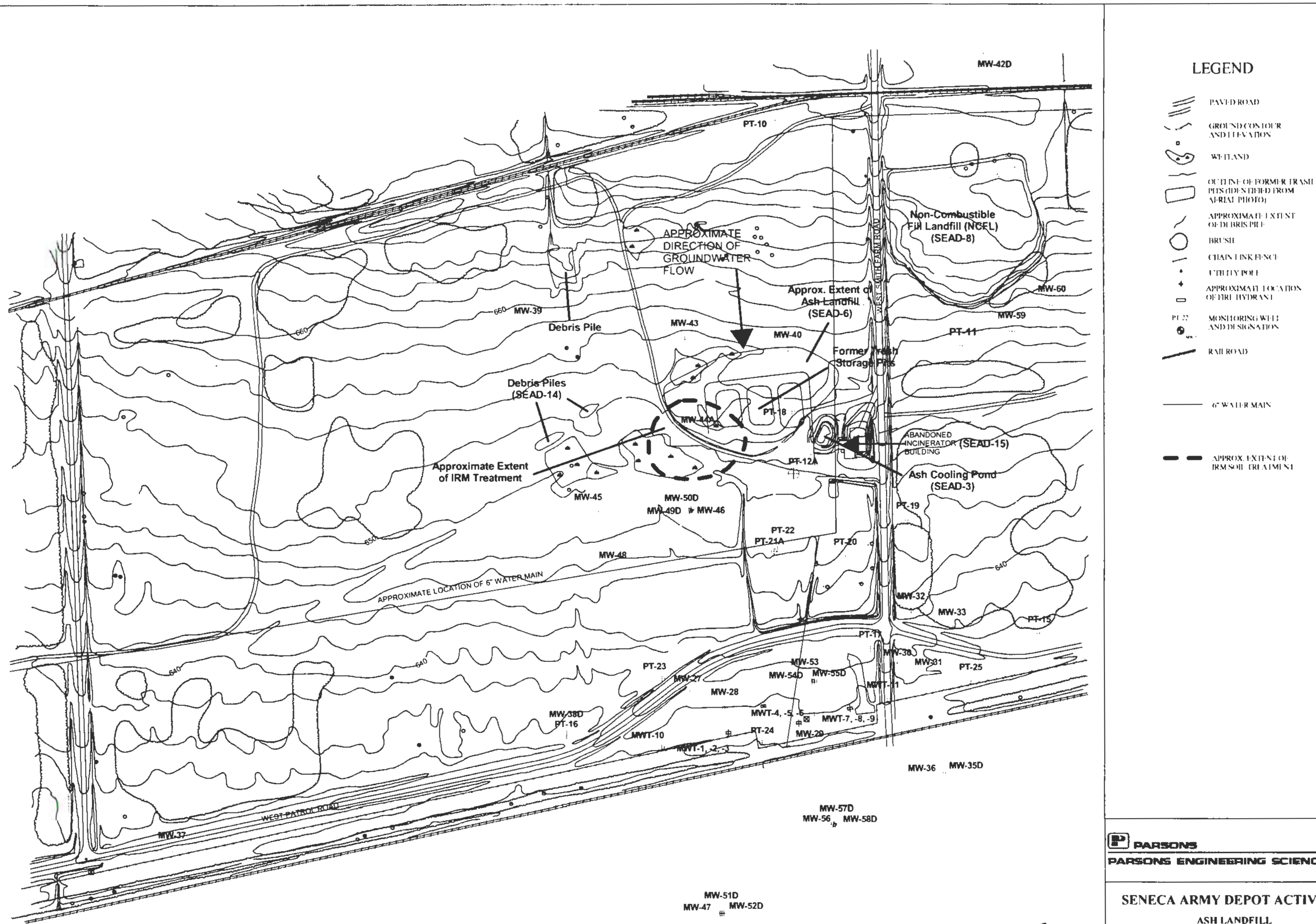

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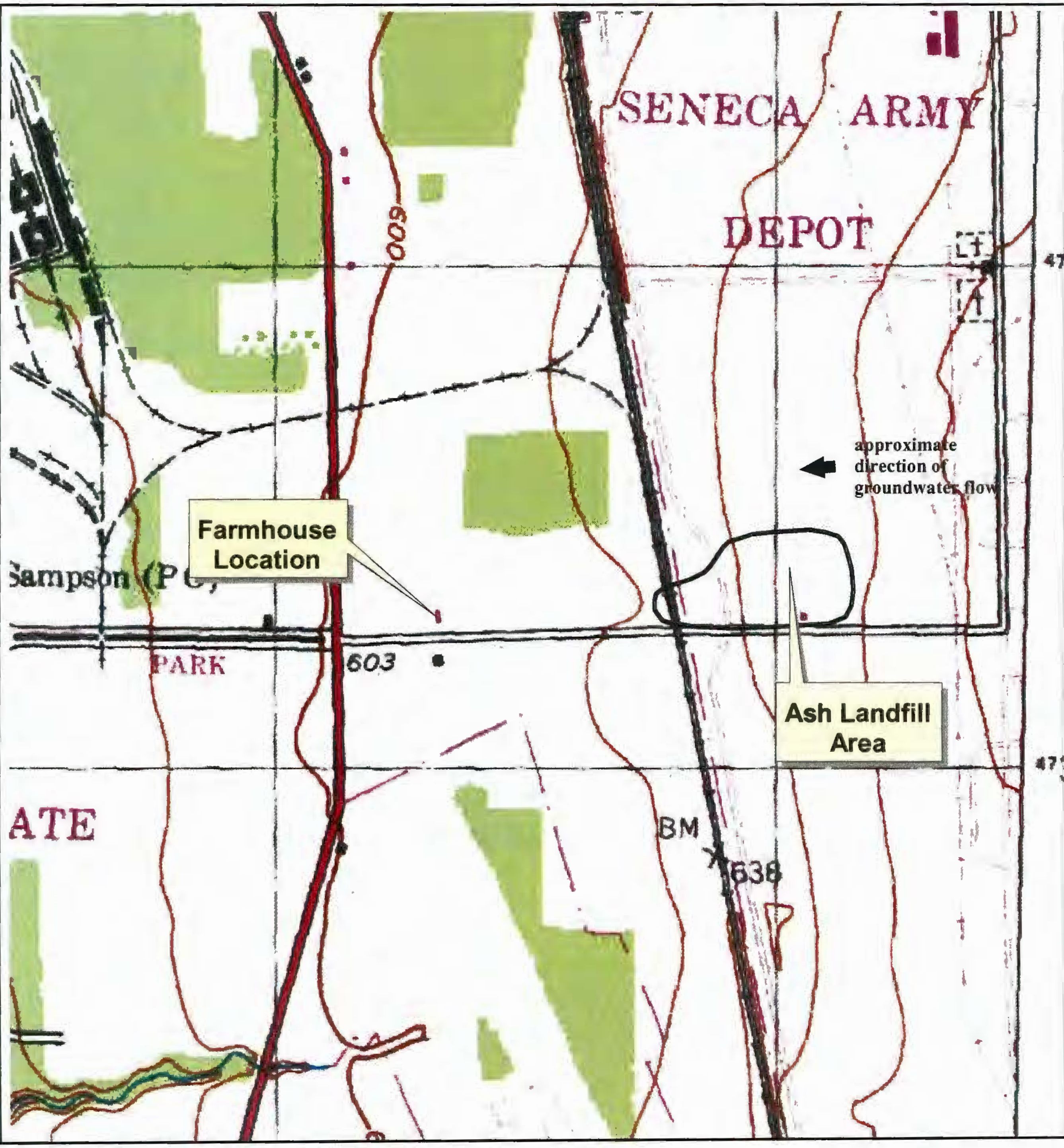
ASH LANDFILL
PROPOSED REMEDIAL ACTION PLAN (PRAP)

FIGURE 2
ASH LANDFILL
SITE MAP

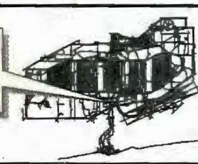
SCALE: 1" = 400'	JUNE 2001



N

Approximate 10 µg/L total chlorinated ethenes isocontour based on groundwater results of January 2000

KEY PLAN



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SENECA ARMY DEPOT ACTIVITY
ASH LANDFILL
PROPOSED REMEDIAL ACTION PLAN (PRAP)

FIGURE 3

LOCATION OF FARMHOUSE AND
TOTAL CHLORINATED ETHENES PLUME

JOB NUMBER: 736677-01001	DATE: JUNE 2001

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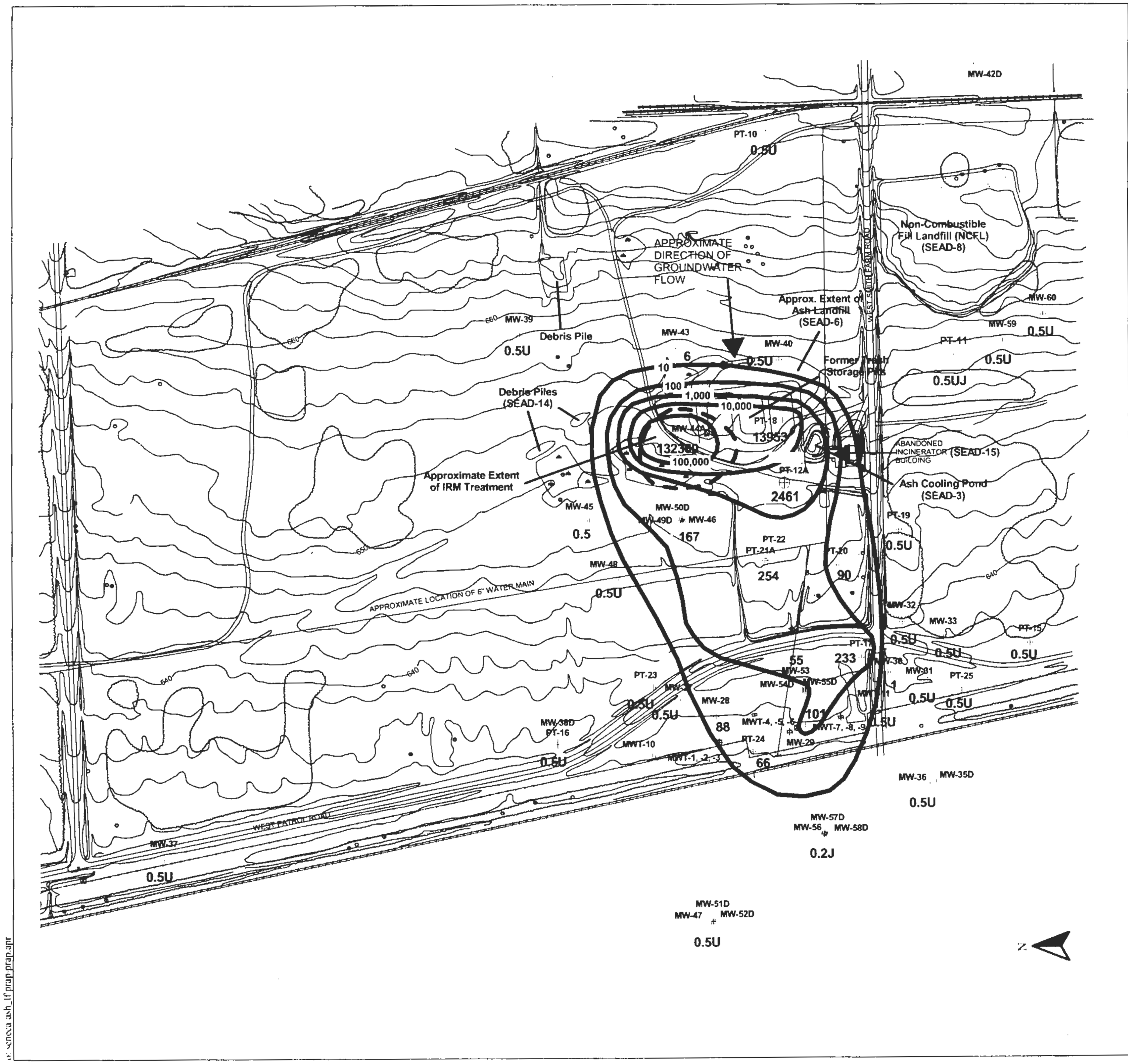

LEGEND

- PAVED ROAD
- 650 GROUND CONTOUR AND ELEVATION
- WETLAND
- OUTLINE OF FORMER TRASH PITS (IDENTIFIED FROM AERIAL PHOTO)
- APPROXIMATE EXTENT OF DEBRIS PILE
- BRUSH
- CHAIN LINK FENCE
- UTILITY POLE
- APPROXIMATE LOCATION OF FIRE HYDRANT
- PT-22 MONITORING WELL AND DESIGNATION
- RAILROAD
- 6" WATER MAIN
- APPROX. EXTENT OF IRM SOIL TREATMENT
- 1,000 GROUNDWATER ISOCONTOUR (ug/L)
- 75 TOTAL CHLORINATED ETHENES (ug/L) FROM SAMPLES COLLECTED IN JUNE 1993
- 0.5U NO CHLORINATED ETHENES DETECTED (HIGHEST INDIVIDUAL CHLORINATED ETHENE DETECTION LIMIT IS SHOWN)
- 0.5J ESTIMATED VALUE
- 0.5UJ ESTIMATED DETECTION LIMIT

NOTE:
THE CONCENTRATIONS SHOWN ON THIS FIGURE ARE FOR WELLS SCREENED IN THE TILLED/WEATHERED SHALE AQUIFER.

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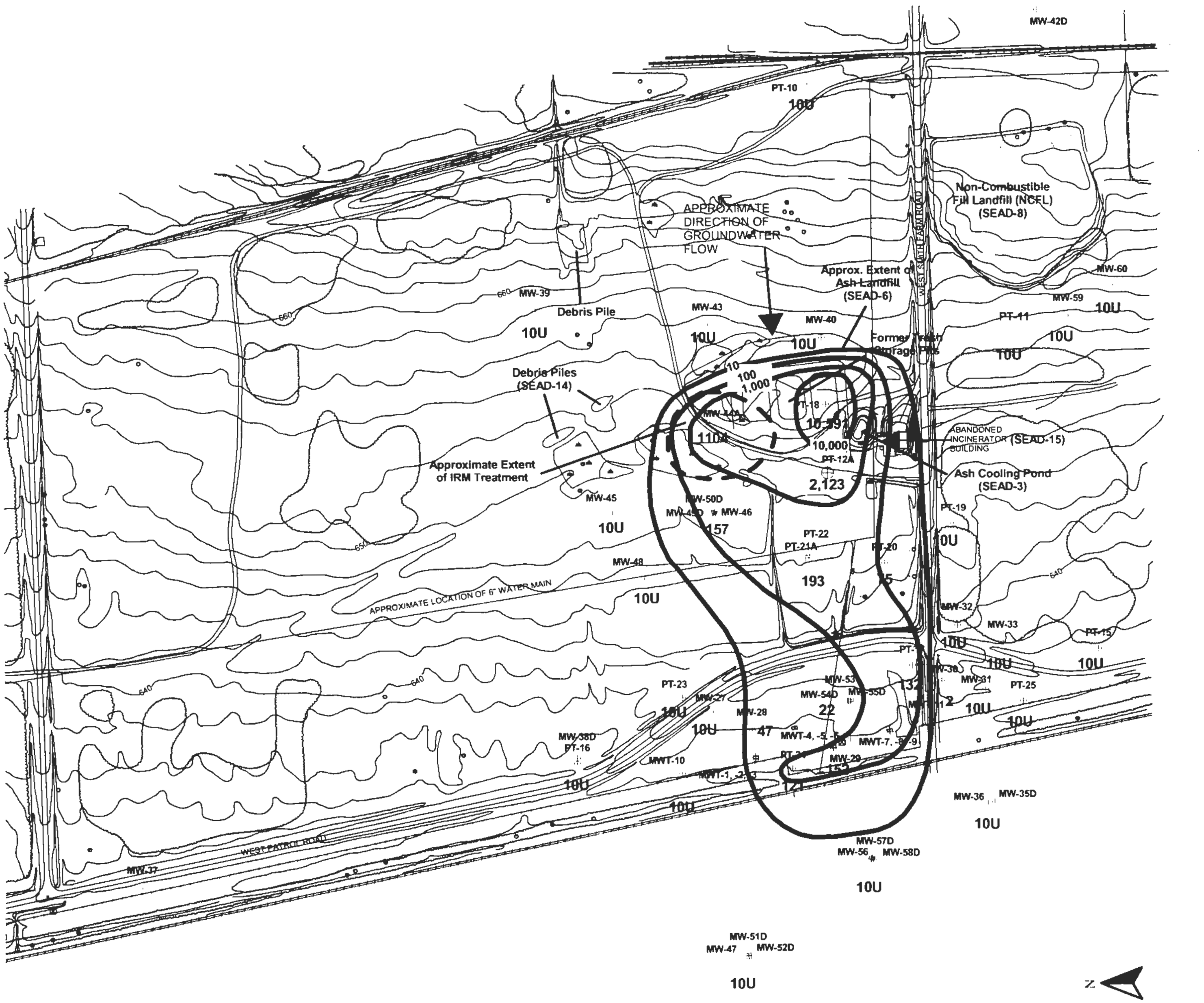
SENECA ARMY DEPOT ACTIVITY
ASH LANDFILL
PROPOSED REMEDIAL ACTION PLAN (PRAP)

FIGURE 4
TOTAL CHLORINATED ETHENES IN GROUNDWATER PRE-IRM PLUME

SCALE: 1" = 400' | JUNE 2001



LEGEND

- PAVED ROAD
- GROUND CONTOUR AND ELEVATION (650)
- WETLAND
- OUTLINE OF FORMER TRASH PITS (IDENTIFIED FROM AERIAL PHOTO)
- APPROXIMATE EXTENT OF DEBRIS PILE
- BRUSH
- CHAIN LINK FENCE
- UTILITY POLE
- APPROXIMATE LOCATION OF FIRE HYDRANT
- MONITORING WELL AND DESIGNATION (PT-22)
- RAILROAD
- 6" WATER MAIN
- APPROX. EXTENT OF IRM SOIL TREATMENT
- 1,000 — GROUNDWATER ISOCONTOUR (ug/L)
- 75 — TOTAL CHLORINATED ETHENES (ug/L) FROM SAMPLES COLLECTED IN OCTOBER 1999
- 10U — NO CHLORINATED ETHENES DETECTED (HIGHEST INDIVIDUAL CHLORINATED ETHENE DETECTION LIMIT IS SHOWN)

NOTE:
THE CONCENTRATIONS SHOWN ON THIS FIGURE ARE FOR WELLS SCREENED IN THE TILLED/WEATHERED SHALE AQUIFER.

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SENECA ARMY DEPOT ACTIVITY
ASH LANDFILL
PROPOSED REMEDIAL ACTION PLAN (PRAP)

FIGURE 5
TOTAL CHLORINATED ETHENES IN GROUNDWATER POST-IRM PLUME

SCALE: 1" = 400' | JUNE 2001

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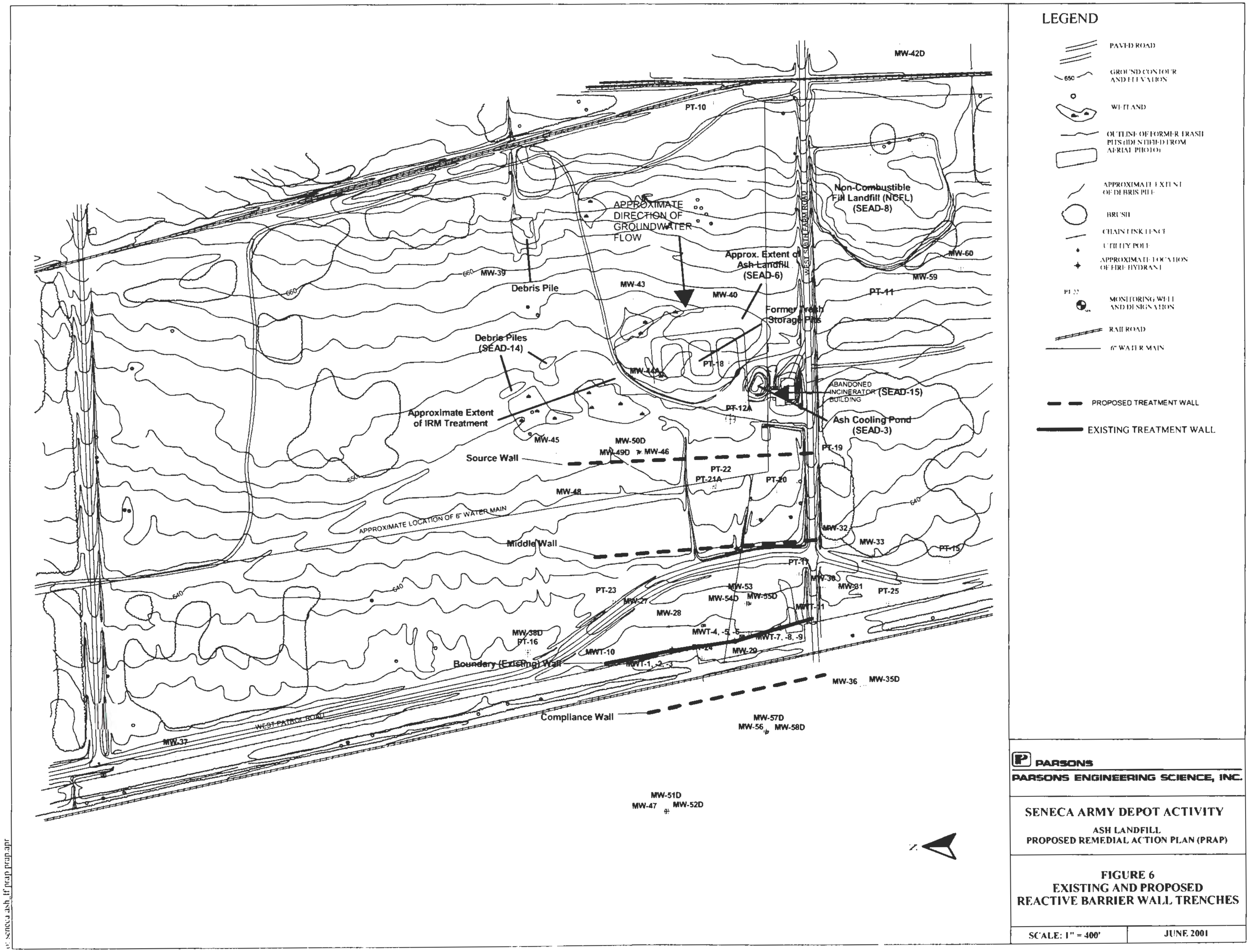

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SENECA ARMY DEPOT ACTIVITY

ASH LANDFILL
PROPOSED REMEDIAL ACTION PLAN (PRAP)

FIGURE 6
EXISTING AND PROPOSED
REACTIVE BARRIER WALL TRENCHES

SCALE: 1" = 400'	JUNE 2001

Response to Comments
From
New York State Department of Environmental Conservation (NYSDEC)

Draft-Final Proposed Remedial Action Plan (PRAP) for the Ash Landfill and the Draft Feasibility Memorandum for Groundwater Remediation Alternatives using Zero Valence Iron Continuous Reactive Wall at the Ash Landfill
Seneca Army Depot Activity, Romulus, NY

Comments Dated April 6, 2001

This is regarding the above referenced Draft-Final Proposed Remedial Action Plan (PRAP) and the Draft Feasibility Memorandum for Groundwater Remediation Alternatives Using Zero Valence Iron Continuous Reactive Wall at the Ash Landfill prepared by Parsons Engineering-Science (Parsons ES) for SEDA through the U.S. Army Corps of Engineers New York District and Huntsville Division.

In addition to the changes made to the document Draft-Final Proposed Remedial Action Plan (PRAP) as requested in the comments below, the results and conclusions of the Treatability Study for the reactive iron wall and the groundwater flow and transport modeling of different treatment wall configurations have been incorporated into remedial option MC-3a. The costs of this option have been updated to reference the costs that have been developed in the Draft Feasibility Memorandum.

Comment No. 1: A Table of Contents should be included.

Response No. 1: Agreed. A Table of Contents has been included.

Comment No. 2: As requested in our comment letter of October 9, 1997, "a map, or schematic is required to locate and identify the Ash Landfill, non-Combustible Landfill, groundwater plume and farmhouse". The farmhouse is not depicted in any of the figures in the current Proposed Plan.

Response No. 2: Agreed. The location of the farmhouse relative to the Ash Landfill and the groundwater plume is shown on new Figure 3. Figures 3 through 5 have been renamed as Figures 4 through 6.

Comment No. 3: Under the Preferred Alternative, the discussion on the contingency plan involving air sparging is limited to one sentence and should be expanded. A reference to the discussion on Alternative MC-3, Air Sparging of Plume, should also be included.

Response No. 3: Agreed. The following paragraph has been added:
"A contingency plan will be developed as part of this preferred alternative. The contingency plan will include additional monitoring and air sparging, as necessary. Following installation of the reactive walls, groundwater from monitoring well MW-56 (see Figure 2 for location) will be analyzed and the VOC results will be compared to the Class GA groundwater standards (trigger criteria). If a statistical analysis of the data for this well shows exceedances of Class GA standards, additional remedial action will be required. Temporary wells will be installed in the vicinity of MW-56, and the results will be used to develop an approach for air sparging. A description of the air sparging process is summarized in Alternative MC-3. If concentrations at MW-56 continue to exceed the trigger values following air sparging, an activated carbon system for the farmhouse water supply system will be installed or public water will be delivered to the house. More extensive air sparging will be performed until trigger values are no longer exceeded."

Comment No. 4: For Alternative SC-3, the Department still believes that the cap would be required to meet 6NYCRR Part 360, despite the Army's response to NYSDEC comments. However, because the preferred alternative does not suggest this technology, the NYSDEC feels resolution may not be essential.

Response No. 4: Agreed. The Army will resolve this issue if required at a later date.

Comment No. 5: In response to NYSDEC comments (specifically comment # 13 of April 25, 1997, comment # 1 and # 2 of October 9, 1997) the Army states that if there is contamination detected in the early warning wells an activated carbon treatment system will be placed at the farmhouse to provide assurance that the water supply is protected, however this is not located anywhere in the body of the Proposed Plan. Please reconcile.

Response No. 5: Agreed. See Response No. 3.

Comment No. 6: As requested in Comment # 14 in the State's comment letter of April 27, 1997, the Proposed Plan should include a table showing the details of groundwater contamination and applicable ARARs.

Response No. 6: Agreed. A new Table 5 shows the concentrations of the total VOCs detected in the groundwater monitoring wells for four sampling rounds: June 1993, June 1997, October 1999 and January 2000. VOCs are summarized since they are the contaminants of concern. This table shows the VOC concentration changes with time. Other contaminants detected in the wells are discussed in the PRAP under *Non-Time Critical Removal Action Summary.* Table 7 has been inserted into the PRAP and provides a list of the applicable ARARs as listed in the *Feasibility Study Report at the Ash Landfill Site* (Parsons, December 1996).

Comment No. 7: On Table 2, there should be a footnote explaining that "Table 2 is different from Table 1 in that the VOCs and Semi-VOCs from soil samples within the areas where the IRM was performed were excluded from the calculations," as stated in Army Response # 14. The title "All Soil Sample Results – Post IRM" is misleading if the table merely reflects pre-IRM sample results with certain data deleted.

Response No. 7: Agreed. The above referenced footnote has been added to Table 2. The title of Table 2 has also been changed to "Soil sample results from outside of the IRM area only – pre IRM".

General Comment: Although the Department does not agree with all of the suggestions and conclusions made, the NYSDEC believes that the Draft Feasibility Memorandum of August 2000 is sufficient for backup documentation for the Proposed Plan. The Department agrees that the treatability study is sufficient to demonstrate that an adequate iron filing permeable reactive barrier (PRB) will degrade the chlorinated solvents present in site groundwater. We encourage the inclusion of additional design methods outlined in the Interstate Technology Regulatory Cooperation document relative to PRBs in addition to reliance on mathematical calculation estimates provided by vendors.

Response: Agreed. The Army will consider additional design methods outlined in ITRC guidance and other cooperative publications during the final design of the permeable reactive walls.

Response to Comments from US EPA

Response to Comments
From
United States Environmental Protection Agency (US EPA)

Draft Final Proposed Remedial Action Plan (PRAP)
Ash Landfill
Seneca Army Depot Activity, Romulus, NY

Comments Dated February 12, 2001

This is regarding the above referenced Draft Final Proposed Remedial Action Plan (PRAP) for the Ash Landfill prepared by Parsons Engineering-Science (Parsons ES) for SEDA through the U.S. Army Corps of Engineers New York District and Huntsville Division.

General Comment No. 1: First, as you know, the proposed plan is a document to facilitate public involvement in the remedy selection process. Accordingly, grammatical propriety plays a critical part in the presentation of this document. Additionally, the font size used in the text of the document is below what is considered standard font size (EPA uses 10 pt, Arial True Text Font for these types of documents). The amount of typographical and grammatical errors found within this "draft final" version of the document can only be judged as careless. I am enclosing our mark-up copy for your reference. Please note that EPA may choose not to accept any future documents with smaller than standard text font sizes, and will not spend time correcting typographical errors and rewriting sentences to make sense of a document that is required to be easily readable and understood by the public. The Army itself should proof read and review all documents before submitting them to the regulatory agencies for review.

Response: Agreed. The document has been reformatted as suggested. Typographical and grammatical errors have been corrected.

General Comment No. 2: The remedy includes the excavation of debris and a vegetative cover over the landfill to address the contaminant sources, and an iron reactive wall for the groundwater contamination. However, there is no mention of institutional controls or 5-year reviews as per CERCLA Section 121 (c), NCP Section 300.430 (f) (4) (ii), and OSWER Directives 9355.7-02 (May 23, 1991), 9355.7-02A (July 26, 1994), and 9355.7-03 (December 21, 1995). Both must be included as components of the preferred remedy, or for any other remedy that does not result in unlimited and unrestricted use.

Response: Agreed. Institutional controls and 5-year reviews are required per CERCLA Section 121 (c), NCP section 300.430 (f) (4) (ii), and OSWER Directives 9355.7-02 (May 23, 1991), 9355.7-02A (July 26, 1994), and 9355.7-03A (December 21, 1995). Institutional controls will consist of deed restrictions to prevent future owners from performing certain actions at the site including use of the site groundwater for potable water and disturbance of the landfill areas. The deed restrictions will be placed in the property files associated with the site. A mechanism for enforcing the deed restrictions will be implemented.

Section 300.430 (f)(4)(ii) of the NCP states that "if a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after initiation of the selected remedial action". Since waste materials and contaminated groundwater will remain onsite following remediation, five-year reviews will be required. The five-year reviews are intended to evaluate whether the response actions remain protective of public health and the environment. The five-year review involves document review, ARAR review, interviews, inspection/technology review and reporting.

The preferred alternative for the Ash Landfill Operable Unit will contain 5-year review and institutional control provisions.

General Comment No. 3: It also appears that the present-worth costs were calculated based on a 10 percent interest rate. Recent guidance recommends a range of 5 to 7 percent. Therefore, the present worth cost estimates need to be recalculated.

Response: Disagree. The present-worth costs are developed for comparative purposes screening remedial alternatives. Although the 10 percent interest rate is somewhat high, it is reflected in the costs of all alternatives. Additionally, the present-worth costs using a 10 percent interest rate are presented in Feasibility Study (FS). Recalculations of the costs in the PRAP would result in the costs, which are different, than the costs presented in the FS.

General Comment No. 4: The proposed plan should include page numeration and appendixes with figures and tables identified with the text.

Response: Agreed. Page numeration and appendices tabs have been added.

General Comment No. 5: The Response to Comments and a redline/strikeout of the draft PRAP should not be a bound part of the PRAP. They may be submitted separately if intended to illustrate how comments have been addressed.

Response: Agreed. The redline/strikeout version of the draft PRAP has been removed. A separate redline/strikeout version of the draft-final PRAP is provided separately.

Specific Comment No. 1: Purpose *of Proposed Plan, 1st column, Page 1*: Please add a paragraph with a brief description of the preferred remedy.

Response: Agreed. A brief description of the preferred remedy has been added.

Specific Comment No. 2: Remedial *Investigation (RI) Summary, 2nd Paragraph, Page 2: Explain* possible sources for the Volatile Organic Compounds (VOCs) contaminants since the landfill is alleged to have been used mainly for domestic waste.

Response: Agreed. The following sentences have been added to the text: "The source of the Volatile Organic Compounds was most likely the three alleged solvent dump areas located at the "Bend in the Road", northwest of the Ash Landfill. The source of the VOCs that were allegedly disposed in this area is unknown."

Specific Comment No. 3: *Non Time Critical Removal Action (RA) Summary, 1st Column, 1st Paragraph, 5th Sentence, Page 3:* Please replace word "eliminated risk" with "reduced risks to acceptable levels."

Response: Agreed. The requested change was made.

Specific Comment No. 4: *Non Time Critical Removal Action (RA) Summary, 1st Column, 1st Paragraph, 3rd to last Sentence, Page 3: Please* identify VOCs cleanup criteria (e.g., NYSDEC Class GA groundwater).

Response: Agreed. The text has been modified to identify the VOC cleanup criteria for soil, the NYSDEC TAGM values.

Specific Comment No. 5: *Non Time Critical Removal Action (RA) Summary, 2nd Column, 4th Paragraph, 2nd Sentence, Page 3: The* statement "thermal treatment is not effective in removing metals from soil," is technically correct. However, a discussion of what can be said about metals should follow.

Response: Since the soils were removed for offsite disposal and treatment was not necessary, a discussion on metals treatment was not included. The TCLP testing was performed to determine if the soils exhibited hazardous characteristics and required treatment prior to disposal. The soils did not exhibit hazardous characteristics.

Specific Comment No. 6: *Non Time Critical Removal Action (RA) Summary, 2nd Column, last Paragraph, 2nd to last Sentence, Page 3: The* text, "total concentrations of lead in soil were not measured during the IRM" is inconsistent with the sentence that follows, which discusses the measurements of lead in soil made within the IRM area. That mix of conflicting actions within the same paragraph may be confusing to the general public. Please re-work the paragraph.

Response: Agreed. The sentence "Total concentrations of lead in soil were not measured during the IRM" has been removed.

Specific Comment No. 7: *Also, the* continuation of this paragraph at the top of page 4, the given concentrations of lead show no criteria (e.g., 95% UCL, background) to compare with.

Response: Agreed. A sentence has been added to the end of the paragraph which reads " The TAGM cleanup criteria for lead is 24.8 mg/kg."

Specific Comment No. 8: *Non Time Critical Removal Action (RA) Summary, 2nd Column, 3rd Paragraph, 2nd Sentence, Page 4: Please* discuss the Low Stress (low-flow) Purging and Sample Procedure in this section.

Response: Agreed. The text has been modified to state that the EPA Region II Low Stress (low-flow) Purging and Sampling Method was used to reduce the turbidity in the groundwater samples.

Specific Comment No. 9: Summary *of Site Risk, 2nd Column, 2nd, 3rd, and 4th Paragraphs, Page 5: Please* provide the calculated cancer risks and hazard index (HI) for the on-site residential use scenario (the worst case scenario).

Response: Agreed. A sentence has been added to the beginning of the 4th paragraph which states "the carcinogenic risks for potential future residents using groundwater for drinking at SEDA is 1.4×10^{-3}, and the HI is 3.2". Additionally, the carcinogenic risks and HI have been added as requested in Paragraph 2 and 3.

Specific Comment No. 10: Summary *of Site Risk, 1st Column, Page 6: Please* state whether the NYSDEC certified the non presence of endangered or threatened species at this site. Also, discuss the four-step process used for assessing site-related ecological risks in light of EPA guidance, and state whether it went beyond the screening level stage.

Response: Agreed. In the *Rare Species Survey, Seneca Army Depot Activity* (U.S. Department of the Interior Fish and Wildlife Services, September 1996), it is stated that no federally listed endangered or threatened species was identified at SEDA. NYSDEC reviewed and certified this document on December 23, 1996.

The ecological risk assessment was performed in accordance with the *Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites (FWIA)* (October 1994). This guidance outlines a four step process for completing ecological risk assessments as described in the PRAP: site description, contaminant-specific impact assessment, ecological effects of remedial alternatives, and fish and wildlife requirements for implementation of remedial actions. In support of these requirements, the following tasks were completed:

- qualitative and quantitative characterization of ecological communities and dominant nondomesticated plant and animal species in the area of the Ash Landfill;
- selection of receptor species;
- identification of chemicals of potential concern for ecological receptors;
- identification of exposure pathways from the Ash Landfill to target species;
- assessment of exposure of receptors to chemicals of potential concern;
- assessment of the toxicity of chemicals of potential concern for each receptor group or species;
- characterization of risk; and
- estimation of risk uncertainty.

Current guidance outlines an eight step process for conducting ecological risk assessments as summarized in EPA's *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (EPA, June 1997). This guidance was not available at the time that the risk assessment was completed. Based on this eight-step process, the ecological risk assessment, which was performed as part of the RI, met the requirements for the screening level risk assessment.

Specific Comment No. 11: Scope *and Role of Action, 1st Column, Page 6: Please* add a table with brief description of the 25 areas subject to remedial investigation at SEDA. Also, include a discussion about the future land use for the site, and its influence on the decision making process.

Response: Agreed. There are actually 13 areas subject to remedial investigation at SEDA. A table (Table 6) showing these 13 areas has been added. The following paragraph has been added to this section:

"The future land use of the site is listed by the Local Redevelopment Authority (LRA) as recreational/conservation. Cleanup levels, remedial action objectives and remedial alternatives were selected consistent with this intended future land use."

Specific Comment No. 12: Summary *of Remedial Alternatives, 2nd Column, Page 6: The* font for the title should be bold for consistency.

Response: Agreed. The title font has been bolded for consistency.

Specific Comment No. 13: Evaluation *of Alternatives, State Acceptance, 1st Column, Page 15: Please* indicate whether the State has ever preliminarily concurred with the preferred remedy.

Response: In NYSDEC's letter to the Army dated April 6, 2001 concerning the PRAP, NYSDEC states that "because the preferred alternative in the Draft-Final version of this PRAP is technologically equivalent and as stringent or more so than in the Draft PRAP that the NYSDEC conditionally occurred with in a letter dated October 9, 1997, the NYSDEC also finds the latest iteration of the PRAP acceptable." The Army believes that this letter indicates that the Department has preliminarily concurred with the preferred remedy.

Specific Comment No. 14: Evaluation *of Alternatives, Summary, 1st Column, Page 15: Please* include definition of "threshold criteria" in the Glossary.

Response: Agreed. The definition of threshold criteria has been added to the glossary.

Specific Comment No. 15: Preferred *Alternative, 2nd Column, 3rd Paragraph, Page 15: Please* add the requirement to establish vegetative soil cover in addition to the maintenance of it.

Response: Agreed. The paragraph has been rewritten as follows:
"Based on an evaluation of the various options, the U.S. Army recommends Alternative SC-5. This alternative includes excavation and off-site disposal of the debris piles, establishment and maintenance of a vegetative soil cover for the Ash Landfill and NCFL for source control, and installation of three in-situ permeable reactive barrier walls filled with a 50/50 mixture of sand and zero valence iron (MC-3a) for migration control of the groundwater plume as the preferred remedy for the site."

Specific Comment No. 16: Preferred *Alternative, 2nd Column, 5th Paragraph, 5th Sentence, Page 15: The* explanation for the contingency plan should be more comprehensive. Include trigger criteria, provision for alternate drinking water supply, and say what the contingency plan is (if alternative 3).

Response: Agreed. The furthest downgradient permeable reactive barrier wall will be located immediately upgradient of the western property line. Three additional shallow monitoring wells will be installed between this wall and the property line. These wells will be used to assess the effectiveness of the barrier wall.

A contingency plan will be developed as part of this preferred alternative. The contingency plan will include additional monitoring and air sparging, as necessary. Following installation of the reactive walls, groundwater from monitoring well MW-56 (see Figure 2 for location) will be analyzed and the VOC results will be compared to the Class GA groundwater standards (trigger criteria). If a statistical analysis of the data for this well shows exceedances of Class GA standards, additional remedial action will be required. Temporary wells will be installed in the vicinity of MW-56, and the results will be used to develop an approach for air sparging. A description of the air sparging process is summarized in Alternative MC-3. If concentrations at MW-56 continue to exceed the trigger values following air sparging, an activated carbon system for the farmhouse water supply system will be installed or public water will be delivered to the house. More extensive air sparging will be performed until trigger values are no longer exceeded.

Specific Comment No. 17: Preferred *Alternative, 2nd Column, 4th Paragraph, 2nd to last Sentence, Page 15:* Please cite by specific reference and provide a more explicit discussion of what the NCP goal against off site disposal is referred to in this sentence. Otherwise, please remove the statement. EPA is uncertain that the Army interpretation of this goal is consistent with its own.

Response: Agreed. The statement that "and is therefore consistent with the goals of the NCP against off-site disposal" has been removed.

Specific Comment No. 18: Preferred *Alternative, 2nd Column, last Paragraph, 5th Sentence, Page 15: Please* note that remaining residual contamination requires five-year reviews and institutional controls.

Response: Agreed. The following paragraph has been added to the end of the section:
"Since this alternative will result in contaminants remaining at the site which exceed levels which allow unlimited use and unrestricted exposure, institutional controls and five-year reviews will be required. Institutional controls will consist of deed restrictions to prevent future owners from ingesting site groundwater and disturbing the landfill cap. The five-year reviews are intended to evaluate whether the response actions remain protective of public health and the environment and will consist of document review, ARAR review, interviews, inspection/technology review and reporting."

Specific Comment No. 19: Table *5, SC-2: The* long-term criterion incorrectly states "on-site" landfill. Please correct to off-site landfill.

Response: Agreed. The correction was completed.