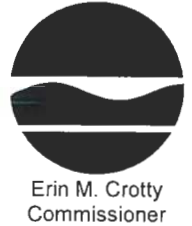


50-12

New York State Department of Environmental Conservation
Division of Environmental Remediation, 12th Floor
625 Broadway, Albany, New York 12233-7011
Phone: (518) 402-9706 • **FAX:** (518) 402-9020
Website: www.dec.state.ny.us



OCT 11 2002

Mr. Stephen Absolom
Chief, Engineering and Environmental Division
Seneca Army Depot Activity (SEDA)
5786 State Route 96
Romulus, NY 14541-5001

Dear Mr. Absolom:

Re: Proposed Plan for Ash Landfill Operable Unit
Seneca Army Depot, #850006

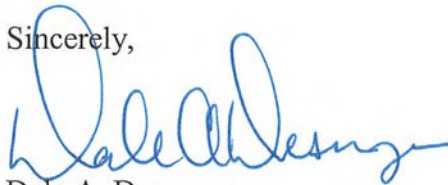
The New York State Departments of Health and Environmental Conservation (NYSDEC) have reviewed the Proposed Plan for the Ash Landfill Operable Unit at the former Seneca Army Depot. Based upon this review, it is our understanding that the Army's preferred alternative includes:

- Excavation and off-site disposal of approximately 770 cubic yards (CY) of debris piles;
- Installation of three additional permeable reactive barrier walls filled with zero-valence iron;
- Establishment and maintenance of a 12-inch thick soil cover over the Non-Combustible Fill Landfill (NCFL) and ash landfill;
- Long-term groundwater monitoring and institutional controls in the form of deed restrictions prohibiting disturbance of the soil cover and prohibiting exposure to groundwater;
- The proposal also includes a contingency plan which includes additional monitoring and air sparging.

The State concurs with the Army's proposal to seek public review and comment on this alternative. Please note that if the remedy ultimately selected for this operable unit includes institutional controls, as is being proposed, than the Record of Decision should include language which obligates the property owner to certify, on an annual basis, that all institutional controls are in effect.

Please find enclosed a comment letter by Alicia Thorne on the Proposed Plan. Please address these comments in preparing the Record of Decision. If you have any questions on this matter, please contact Ms. Thorne at (518) 402-9623.

Sincerely,



Dale A. Desnoyers
Acting Director
Division of Environmental Remediation

Enclosure

cc: G. Litwin
M. VanValkenburg/C. Bethoney
R. Wing/J. Vazquez

PROPOSED PLAN SUMMARY SHEET

Site Number: 8-50-006 - Ash Landfill Operable Unit (OU)
Name of Site: Seneca Army Depot
Town and County: Romulus, Seneca County

PREPARED BY:

U.S. Army (SEDA)

DESCRIPTION OF THE PROBLEM:

Activities at the Ash Landfill OU (SEADs-3, 6, 8, 14, and 15) included the burning of trash in a series of burn pits (SEADs 14 and 15) which resulted in the disposal of the burning pits' ashes in the Ash Landfill (SEAD-6). Domestic waste was also burned in an incinerator which generated ash that was temporarily stored in an unlined cooling pond (SEAD-5) and ultimately disposed of in a Non-Combustible Fill Landfill (NCFL) (SEAD-8). Unpermitted disposal of solvents apparently occurred here also. The main contaminants of concern at the Ash Landfill OU are VOCs (primarily chlorinated and aromatic compounds), SVOCs (mainly PAHs), and to a lesser degree, metals.

To address the soil source of the groundwater contaminant plume, an IRM was performed in 1995 that called for the excavation and thermal treatment of VOC-impacted soils to TAGM levels. As an additional IRM/treatability study, a permeable reactive barrier was installed in 1998 on the downgradient edge of the VOC plume. Although the barrier has proven to be effective in remediating the VOC contaminated groundwater, additional treatment is necessary.

This Proposed Plan addresses the contaminated groundwater and the remaining soils at the debris piles and the NCFL.

DESCRIPTION OF PROPOSED ALTERNATIVE:

The proposed remedy for the Ash Landfill OU includes migration control and source control:

- Installation of three additional permeable reactive barrier walls filled with zero-valence iron;
- Excavation and off-site disposal of the debris piles (approximately 770 CY);
- Establishment and maintenance of a 12-inch vegetative cover over the NCFL and ash landfill;
- Institutional controls in the form of deed restrictions prohibiting disturbance of the vegetative cover, prohibiting human or ecological exposure to groundwater, and posting of signs and warnings;
- Long-term groundwater monitoring to monitor the effectiveness of the treatment;
- Contingency plan including additional monitoring and air sparging.

October 11, 2002

Mr. Stephen Absolom
Chief, Engineering and Environmental Division
Seneca Army Depot Activity (SEDA)
5786 State Route 96
Romulus, NY 14541-5001

Re: Seneca Army Depot Activity
NYS Inactive Hazardous Waste Disposal Site No. 8-50-006
Final Proposed Plan for the Ash Landfill

Dear Mr. Absolom:

The New York State Departments of Environmental Conservation (NYSDEC) and Health (NYSDOH) have reviewed the above referenced document dated July 2002. Comments are as follow:

Army's Response to Comments:

1. Contrary to what is stated in the Army's response to NYSDEC's April 6, 2001 comment #2, the location of the farmhouse relative to the groundwater plume is not indicated in any of the figures in this document.

General Comments:

This document is rather difficult to discuss without section numbering. The Army should include section numbers to help differentiate sections and subsections.

There were several typographical errors noted in this document, similar to those pointed out in our teleconference of July 16, 2002 on the SEADs 25 and 26 Draft Final Proposed Plan. The Army should review and revise these errors. For instance, the phrase "will" is used in several areas where "would" should be used. The term "PRAP" appears many times throughout the document, and in each instance, it should be replaced with "Proposed Plan." Also, the page numbering of this document is in need of revision.

Specific Comments:

1. Page 1, Purpose of Proposed Plan: In the third sentence, please remove the phrase "with support from" and replace it with more appropriate wording such as "in cooperation with." The USEPA and NYSDEC entered into the Federal Facilities Agreement as equal entities therefore the regulatory agencies are not "support" agencies as otherwise indicated.
2. Page 3, Remedial Investigation Summary: The first sentence in this paragraph is extraneous and should be stricken from the text.

3. Page 9, Summary of Remedial Alternatives: Please revise the statement “Following treatment, post prove-out sampling... areas” to “Following treatment, post excavation sampling... areas”. “Post prove out” is not reader friendly.
4. Page 10, Alternative SC 1: Although it is stated that current security measures would be eliminated or modified to assist in the timely transfer or lease of the property, the Army may want to list what those measures currently are and what the potential change would be.
5. Page 12, third paragraph: Please define “cy/hr”.
6. Page 13, Alternative MC-2: “With the addition of the zero valence iron reactive barrier...has been mitigated.” This is the first place in the document that states that a reactive barrier wall is already in place. The Army should first present this as part of the Remedial Investigation Summary, Groundwater section prior to discussion in the Alternatives section.
7. Page 15, Alternative MC-3a: In the second paragraph, the Army references Alternative MC-3, then in the fourth paragraph Alternative MC-3a is referenced. Please correct accordingly.
8. Page 19, Compliance with ARARs: The Army states in the first paragraph that “NYSDEC TAGM values are guidelines, not standards.” While that may be true, the text should explain that TAGM values are also considered TBCs.
9. Page 21, Implementability: It is assumed that “...verification and conformational testing...” is supposed to read “...verification and confirmational testing...” Please verify.
10. Page 22, Costs: It is stated that no present worth cost was calculated for MC-7, since this alternative was dropped in the feasibility study. Why is MC-7 discussed at all in this section?
11. Page 23, Preferred Alternative, second column, second paragraph: Please revise the last sentence to “The monitoring plan will...drinking water supply wells of site neighbors, i.e. the farmhouse wells.”
12. Glossary: NYSDEC is incorrectly defined as the “New York State Department of Environmental Protection.” The last sentence under TAGM should be removed from the text. There were others errors noted in the glossary that are similar to those discussed in our teleconference of July 16 that should be revised accordingly.
13. Table 1: Footnote 6 should be clarified further.
14. Table 9: Under Alternative MC-3/MC-3a, it states that for ability to attain approvals and coordinate with other agencies, “NYSDEC and EPA input required prior to final remedy selection.” As stated in NYSDEC TAGM #4030, “(A)dmistrative feasibility refers to compliance with applicable rules, regulations, and statutes and the ability to obtain approvals from other offices and agencies.” It is my understanding that administrative feasibility does not include the NYSDEC, USEPA or Army. This table should be revised accordingly.
15. Although the Army has addressed the need for off-site groundwater monitoring using the sentinel well adjacent to the landfill, the Army has not rescinded it’s assumption that no future residential use of the land adjacent to the landfill is planned. The Army has no control over the future use of that land and should not infer that it knows what the property owner’s future intentions are.

If you have any questions, please contact me at (518) 402-9623 or by email at ajthorne@gw.dec.state.ny.us

Sincerely,

A handwritten signature in cursive script that reads "Alicia Thorne".

Alicia Thorne
Bureau of Eastern Remedial Action
Division of Environmental Remediation

cc: J. Vazquez, USEPA
C. Bethoney, NYSDOH
B. Putzig, NYSDEC Region 8
R. Scott, NYSDEC Region 8



STATE OF NEW YORK DEPARTMENT OF HEALTH

Flanigan Square, 547 River Street, Troy, New York 12180-2216

Antonia C. Novello, M.D., M.P.H., Dr.P.H.
Commissioner

Dennis P. Whalen
Executive Deputy Commissioner

October 3, 2002

Mr. Dale Desnoyers, Acting Director
Division of Environmental Remediation
NYS Department of Environmental Conservation
625 Broadway - 12th Floor
Albany, NY 12233-7011

Re: Proposed Plan
Ash Landfill Operable Unit
Seneca Army Depot
Site #850006
Romulus, Seneca County

Dear Mr. Desnoyers:

Staff reviewed the July 2002 Proposed Plan for the Ash Landfill Operable Unit of the Seneca Army Depot site located in Romulus, Seneca County.

I understand the proposed remedy for Ash Landfill contains two components : a soil/sediment source control alternative and a groundwater migration control alternative. The source control alternative includes the excavation and off-site disposal of debris piles and soil caps for the Ash and the Non-Combustible Fill Landfills. The groundwater migration control alternative includes the installation of three zero valence iron reactive walls, similar to the existing one already in place, and groundwater monitoring of the plume to ensure that site-related contaminants are not migrating towards receptors. In addition, language will be included in the deed restricting groundwater use and potential unauthorized interference with the monitoring systems, treatments, or barriers (i.e. capping of landfills).

Although there are many technical/editorial problems with the Proposed Plan, I believe the remedy is protective of public health and concur with it. Enclosed are our comments from Charlotte Bethoney addressing the individual technical issues to include with the State's comments. If you have any questions, please contact Mark VanValkenburg at (518) 402-7860.

Sincerely,

Gary A. Litwin, Director
Bureau of Environmental Exposure Investigation

Enclosure

cc: G.A. Carlson, Ph.D.
Mr. M. VanValkenburg
Mr. D. Miles
Mr. D. Napier, RFO
Mr. B. Dombrowski, SCHD
Mr. B. Putzig, DEC Region 8 Office
Mr. G. Ulirsch, ATSDR
Mr. A. Block, ATSDR

**FINAL 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
30 Dan Road
Canton, Massachusetts**

July 2002

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

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APPENDICES

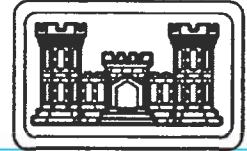
Appendix A.....Response to Comments

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PROPOSED PLAN - FINAL



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



July 2002

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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 Priorities 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.

Non-Time Critical Removal Action Summary

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 Memorandum (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 concentrations of VOCs in groundwater in the area have 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).

A former 1000-gallon underground storage tank (UST) that was used to store heating oil and was located on the east side of the Abandoned Incinerator Building (SEAD-15), was investigated and removed in April 1994 in accordance with the protocols outlined in the NYSDEC STARS memo (August 1992). According to the UST closure report that documented this tank removal, the tank was intact and there was no visual or olfactory evidence of tank leakage in the soil surrounding the UST. This UST removal was not related to the Superfund process.

As part of the Ash Landfill RI, a soil boring program was conducted in the area around SEAD-15 including the adjacent Ash Cooling Pond (SEAD-3) during November 1991. Results from this investigation indicated that concentrations of 29 of the 30 semivolatile compounds were below TAGM criteria. One compound was detected at concentrations exceeding the TAGM criteria. Benzo(a)pyrene was detected at concentrations of 760 J μ g/kg and 120 μ g/kg in two surface soil samples collected adjacent to the cooling pond. The TAGM value for benzo(a)pyrene is 61 μ g/kg. Benzo(a)pyrene was not detected in samples collected below these two surface soil samples indicating that these concentrations were limited to the surface. Benzo(a)pyrene concentrations in surface and subsurface soils were below the TAGM in several other borings in the immediate vicinity of the cooling pond. No pesticides or PCBs were detected in the soil borings, and measured metal concentrations were consistent with background values developed as part of USAEHA Waste Study 37-26-0479-85.

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-WF. 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 ethene 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 1,250 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 and January 2000, the concentrations in MW-44a, the replacement well for MW-44, were 1,104 ug/L and 399 ug/L, 99.5% and 99.8% reductions in concentration. **Figure 3** depicts the groundwater VOC plume before the removal action, and **Figure 4** depicts the groundwater VOC plume based on the results of the most recent (January 2000) groundwater sampling and analysis.

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. Environmental sampling has shown that SEAD-3 (Ash Cooling Pond) and SEAD-15 (Abandoned Incinerator Building) are not of environmental concern. As such, the baseline risk assessment was focused on the Ash Landfill (SEAD-6), NCFL (SEAD-8), and Debris Piles (SEAD-14).

Human Health Risk Assessment

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 Seneca Lake. 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)

As discussed in Section 6 of the RI Report, the human health risk assessment conducted during the RI determined that the site hazard index and total cancer risk for exposure to sediment in on-site wetlands are within the acceptable EPA risk range. However, the ecological risk assessment suggested that, based upon a comparison with all available state and federal guidelines, in addition to literature information, there may exist a slight threat due to the presence of nine metals (arsenic, cadmium, copper, iron, lead, manganese, mercury, nickel, and zinc). During the 1994 Interim Remedial Measure (IRM) for the Ash Landfill, the sediments representing the potential slight risk were excavated. These materials were thermally treated with soil excavated from the "Bend in the Road" area. Following treatment, post prove-out sampling showed that the soils and sediments met the project-specific cleanup goals and were used as backfill at the "Bend in the Road" area and in the excavated wetland areas. Further remediation for wetland sediments is not required.

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 NCFI 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 in the NCFL and less than 2 feet deep at the Ash Landfill and the debris piles. Based on this finding, the expected depth of excavation at the Ash Landfill and debris piles would be 2 feet, whereas the expected depth of excavation at the NCFL will be 10' or less. The results from the RI further indicate that contaminated soils in all three locations could be removed with standard construction equipment. Following consolidation of contaminated soils at the NCFL, the excavated materials would be transported to an off-site Subtitle D landfill for disposal. Clean backfill materials would then be transported to the site and used to fill the excavated areas. 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 in soils outside of the NCFL would be approximately 2 feet. Under this alternative, excavation would not be performed on soils in the NCFL, as soil 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 at levels that do not allow for unlimited use and unrestricted exposure, institutional controls and five-year reviews would be required. Under this alternative, the types of institutional controls that would be implemented will include a combination of administrative and physical controls that are implemented to prevent disturbance of the landfill cap at the NCFL. Administrative controls will include deed restrictions that prohibit activities that disturb the NCFL cap. Physical controls that will be implemented include posting of signs and markers to identify these areas. The five-year reviews are intended to evaluate whether the response actions remain protective of public health and the environment.

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 yd³.

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.

Because this option would result in contaminants remaining on-site at levels that do not allow for unlimited use and unrestricted exposure, institutional controls and five-year reviews would be required. Under this alternative, the types of institutional controls that would be implemented will include a combination of administrative and physical controls that are implemented to prevent disturbance of the landfill cap. Administrative controls will include deed restrictions that prohibit activities that disturb the cap. Physical controls that will be implemented include posting of signs and markers to identify these areas. The five-year reviews are intended to evaluate whether the response actions remain protective of public health and the environment.

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.

Because this option would result in contaminants remaining on-site at levels that do not allow for unlimited use and unrestricted exposure, institutional controls and five-year reviews would be required. Under this alternative, the types of institutional controls that would be implemented will include a combination of administrative and physical controls that are implemented to prevent disturbance of the landfill cap at the NCFL. Administrative controls will include deed restrictions that prohibit activities that disturb the NCFL cap. Physical controls that will be implemented include posting of signs and markers to identify these areas. The five-year reviews are intended to evaluate whether the response actions remain protective of public health and the environment.

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

Because all migration control alternatives result in contaminants remaining on-site at levels that do not allow for unlimited use and unrestricted exposure to groundwater for a period of time, institutional controls and five-year reviews would be required for each proposed migration control alternative. Relative to the migration control alternatives, institutional controls will be used to prevent future owners from ingesting site groundwater. The types of institutional controls that would be implemented will include a combination of administrative and physical controls. Examples of administrative controls that will be implemented at this site for groundwater are deed restrictions that prohibit the following:

- installation of any groundwater extraction wells, except for regulator-approved remediation purposes;
- human or ecological exposure to groundwater from the site(s), or use of this groundwater for any industrial, commercial, sanitary, human consumptive, or agricultural purposes; and
- unauthorized interference with monitoring systems or any additional treatment, monitoring, or barrier (i.e., capping) systems that may be subsequently constructed at the site.

Examples of physical controls that will be implemented at this site will include posting signs and warnings that identify and advise use restrictions. Five-year reviews of the migration control alternatives are intended to evaluate whether the response actions remain protective of public health and the environment.

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 area.

Although current and intended land uses do not indicate unacceptable risks, groundwater quality standards have been exceeded. Detections of low levels of 1,2-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 1,2-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 would 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-situ 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 would 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-3a. 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 cis-1,2-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 fence line 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 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 fence line (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 1,000 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 1,2-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, H₂O₂. 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 1×10^{-5} , 9.4×10^{-6} , 3.7×10^{-6} , which are within the EPA target level of 1×10^{-4} and 1×10^{-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 1.4×10^{-3} , which is also above the EPA target range of 1×10^{-4} and 1×10^{-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

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

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; implementability; 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 for source control and Alternative MC-3a for migration control. Alternative SC-5 accomplishes source control through the excavation and off-site disposal of the debris piles, combined with the establishment and maintenance of a vegetative soil cover for the Ash Landfill and the NCFL. Alternative MC-3a provides migration control for the groundwater contaminant plume through the installation of three in-situ permeable reactive barrier walls that are filled with 100% zero valence iron. Based on the prior removal and NYSDEC-documented closure of the UST at the Abandoned Incinerator Building (SEAD-15), no further action is proposed at this SEAD. During the re-

grading of the debris piles, the Ash Cooling Pond (SEAD-3) will be backfilled and re-graded.

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 that are above levels that allow unlimited use and unrestricted exposure, institutional controls and five-year reviews will be required. For this site, institutional controls are intended to prevent future owners from ingesting site groundwater and/or disturbing the landfill cap. The types of institutional controls that would be implemented will include a combination of administrative and physical controls. Examples of administrative controls that will be implemented at this site are deed restrictions that would prohibit the following:

- installation of any groundwater extraction wells, except for regulator-approved remediation purposes,
- human or ecological exposure to groundwater from the site(s), or use of this groundwater for any industrial, commercial, sanitary, human consumptive, or agricultural purposes, and
- unauthorized interference (to be defined in the Deed) with monitoring systems or any additional treatment, monitoring, or barrier (i.e. capping) systems that may be subsequently constructed at the site. (These systems to be described and locations specified in the Deed to the extent practicable.)

Examples of physical controls that will be implemented at this site will include posting signs and warnings that identify and advise use restrictions at this site.

Implementation and methods of enforcement for specific Institutional Controls will be addressed as part of the Finding of Suitability Transfer (FOST) process. 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 in 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-bound 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)

CWA 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 EPA step beyond its traditional regulatory role and provide response authority to clean up hazardous waste sites. EPA has primary responsibility for managing cleanup and enforcement activities authorized under CERCLA. Under the program, EPA 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 EPA'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 (PAH)

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, EPA 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 can 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 EPA'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 Feasibility 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.

Revegetate

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 in 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 be 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 at 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*

Table 1

**SENECA ARMY DEPOT ACTIVITY
ASH LANDFILL OPERABLE UNIT
ALL SOIL SAMPLE RESULTS - PRE IRM (1)**

COMPOUND	UNITS	NYSDEC TAGM (2)	COUNT	MAXIMUM	95 th UCL of the MEAN (3)	MEAN (4)	STD.DEV
<u>Volatile Organics</u>							
Vinyl Chloride	ug/kg	200	169	14,500	62.5	173	1,134
1,2-Dichloroethene (total)	ug/kg	300	169	79,000	1,712	1,989	8,288
Trichloroethene	ug/kg	700	169	540,000	2,268	9,373	57,446
<u>Semivolatiles</u>							
2-Methylnaphthalene	ug/kg	36,400	164	3,600	441	393	483
Acenaphthylene	ug/kg	41,000	105	510	265	248	108
Dibenzofuran	ug/kg	6,200	164	7,000	398	373	568
Phenanthrene	ug/kg	50,000	164	43,000	658	882	3,693
Benzo(a)anthracene	ug/kg	220 or MDL(5)	164	9,600	520	531	1,143
bis(2-Ethylhexyl)phthalate	ug/kg	50,000	164	230,000	715	2,051	17,995
Benzo(b)fluoranthene	ug/kg	1,100	164	9,500	498	513	1,068
benzo(k)fluoranthene	ug/kg	1,100	164	6,700	469	448	759
Benzo(a)pyrene	ug/kg	61 or MDL(5)	164	9,000	491	486	1,000
Indeno(1,2,3-cd)pyrene	ug/kg	3,200	164	4,800	431	397	543
Dibenz(a,h)anthracene	ug/kg	14 or MDL(5)	164	2,900	411	368	335
Benzo(g,h,i)perylene	ug/kg	50,000	164	5,000	431	392	527
<u>Pesticides/PCBs</u>							
Aroclor-1260	ug/kg	1,000	164	770	157	143	110
<u>Metals</u>							
Cadmium	mg/kg	1.74	163	43.1	3.84	2.47	3.74
Chromium	mg/kg	26.49	163	62	27.7	26.7	7.66
Copper	mg/kg	25	162	836	40.5	43.6	83.1
Lead	mg/kg	30	147	2,890	90	115	387
Zinc	mg/kg	88.89	163	55,700	409	860	4,887

Notes:

1. This table reflects the soil sample results at all depths at the site prior to the Interim Remedial Measure (IRM).
2. NYSDEC TAGM values based on Technical and Administrative Guidance Memorandum HWR-92-4046, January 24, 1994. The TAGMs are soil cleanup guidelines and are for comparison.
3. 95th Upper Confidence Limit of the mean is a probabilistic estimate of the true site mean. Non-detects were assumed to be at one-half of the detection limit for all statistical calculations.
4. Mean is the arithmetic mean, i.e. the sum of the values divided by the number of samples.
5. For semivolatile organic compounds, the Minimum Detection Limit (MDL) is 330 ug/Kg.
6. Metals are total metals in soil.

Table 2

**SENECA ARMY DEPOT ACTIVITY
ASH LANDFILL OPERABLE UNIT
SOIL SAMPLE RESULTS from outside of the IRM AREA ONLY - PRE IRM (1)**

COMPOUND	UNITS	NYSDEC TAGM (2)	COUNT	MAXIMUM	95 th UCL of the MEAN (3)	MEAN (4)	STD.DEV
<u>Volatile Organics</u>							
Vinyl Chloride	ug/kg	200	116	92	6.60	6.68	8.09
1,2-Dichloroethene (total)	ug/kg	300	116	1,300	11.1	23.6	125
Trichloroethene	ug/kg	700	116	540	18.4	22.5	63.8
<u>Semivolatiles</u>							
2-Methylnaphthalene	ug/kg	36,400	112	1,600	359	326	217
Acenaphthylene	ug/kg	41,000	72	510	279	258	109
Dibenzofuran	ug/kg	6,200	112	7,000	406	382	657
Phenanthrene	ug/kg	50,000	112	43,000	819	1,113	4,449
Benzo(a)anthracene	ug/kg	220 or MDL(5)	112	9,600	620	620	1,359
bis(2-Ethylhexyl)phthalate	ug/kg	50,000	112	230,000	901	2,811	21,763
Benzo(b)fluoranthene	ug/kg	1,100	112	9,500	576	591	1,269
benzo(k)fluoranthene	ug/kg	1,100	112	6,700	513	499	890
Benzo(a)pyrene	ug/kg	61 or MDL(5)	112	9,000	556	555	1,186
Indeno(1,2,3-cd)pyrene	ug/kg	3,200	112	4,800	463	423	623
Dibenz(a,h)anthracene	ug/kg	14 or MDL(5)	112	2,900	430	376	350
Benzo(g,h,i)perylene	ug/kg	50,000	112	5,000	456	422	600
<u>Pesticides/PCBs</u>							
Aroclor-1260	ug/kg	1,000	164	770	157	143	110
<u>Metals</u>							
Cadmium	mg/kg	1.74	163	43.1	3.84	2.47	3.74
Chromium	mg/kg	26.49	163	62	27.7	26.7	7.7
Copper	mg/kg	25	162	836	40.5	43.6	83.1
Lead	mg/kg	30	147	2,890	90.0	115	387
Zinc	mg/kg	88.89	163	55,700	409	860	4,887

Notes:

- This table reflects soil sample results at all depths at the site prior to the Interim Remedial Measure (IRM).
Table 2 is different from Table 1 in that the VOCs and SVOCs from soil samples within the areas where the IRM was performed were excluded from the calculations.
- NYSDEC TAGM values based on Technical and Administrative Guidance Memorandum HWR-92-4046, January 24, 1994. The TAGMs are soil cleanup guidelines and are for comparison.
- 95th Upper Confidence Limit of the mean is a probabilistic estimate of the true site mean. Non-detects were assumed to be at one-half of the detection limit for all statistical calculations.
- Mean is the arithmetic mean, i.e. the sum of the values divided by the number of samples.
- For semivolatile organic compounds, the Minimum Detection Limit (MDL) is 330 ug/Kg.
- Metals are total metal concentrations in soil.

Table 3

**SENECA ARMY DEPOT ACTIVITY
ASH LANDFILL OPERABLE UNIT
SOIL SAMPLE RESULTS within the IRM AREA ONLY - PRE IRM (1)**

COMPOUND	UNITS	NYSDEC TAGM(2)	COUNT	MAXIMUM	95th UCL of the MEAN (3)	MEAN (4)	STD.DEV
<u>Volatile Organics</u>							
Vinyl Chloride	ug/kg	200	53	14,500	2,262	536	1,991
1,2-Dichloroethene (total)	ug/kg	300	53	79,000	406,336	6,292	13,942
Trichloroethene	ug/kg	700	53	540,000	1,690,008	29,839	100,199
<u>Semivolatiles</u>							
2-Methylnaphthalene	ug/kg	36,400	52	3,600	669	539	782
Acenaphthylene	ug/kg	41,000	33	365	257	227	104
Dibenzofuran	ug/kg	6,200	52	2,050	423	354	300
Phenanthrene	ug/kg	50,000	52	2,050	472	386	378
Benzo(a)anthracene	ug/kg	220 or MDL(5)	52	2,050	412	341	312
bis(2-Ethylhexyl)phthalate	ug/kg	50,000	52	2,050	489	413	333
Benzo(b)fluoranthene	ug/kg	1,100	52	2,050	417	346	312
benzo(k)fluoranthene	ug/kg	1,100	52	2,050	408	337	314
Benzo(a)pyrene	ug/kg	61 or MDL(5)	52	2,050	410	338	315
Indeno(1,2,3-cd)pyrene	ug/kg	3,200	52	2,050	411	341	307
Dibenz(a,h)anthracene	ug/kg	14 or MDL(5)	52	2,050	418	349	301
Benzo(g,h,i)perylene	ug/kg	50,000	52	2,050	399	328	311
<u>Pesticides/PCBs</u>							
Aroclor-1260	ug/kg	1,000	52	770	216	181	155
<u>Metals</u>							
Cadmium	mg/kg	1.74	52	4.4	2.23	1.87	1.59
Chromium	mg/kg	26.5	52	34.8	25.2	24.2	4.48
Copper	mg/kg	25	52	146	34.2	29.6	20.2
Lead	mg/kg	30	50	696	54.4	46.3	103
Zinc	mg/kg	88.9	52	3,540	244	241	508

Notes:

1. Soil samples results at all depths in the Interim Remedial Measure area only, prior to the IRM, are included..
2. NYSDEC TAGM values based on Technical and Administrative Guidance Memorandum HWR-94-4046, January 24, 1994. The TAGMs are cleanup guidelines and are for comparison.
3. 95th Upper Confidence Limit of the mean is a probabilistic estimate of the true site mean. Non-detects were assumed to be at one-half of the detection limit for all statistical calculations.
4. Mean is the arithmetic mean, i.e. the sum of the values divided by the number of samples.
5. For semivolatile organic compounds the Minimum Detection Limit (MDL) is 330 ug/Kg.

Table 4

**SENECA ARMY DEPOT ACTIVITY
ASH LANDFILL OPERABLE UNIT
SOIL SAMPLE RESULTS within the IRM AREA ONLY - POST IRM (1)**

COMPOUND	UNITS	NYSDEC TAGM (2)	COUNT	MAXIMUM	95th UCL of the MEAN (3)	MEAN (4)	STD.DEV
<u>Volatile Organics</u>							
Vinyl Chloride	ug/kg	200	156	28	9.24	8.29	7.17
1,2-Dichloroethene (total)	ug/kg	300	156	47	9.41	8.35	8.04
Trichloroethene	ug/kg	700	156	46	9.62	8.05	8.14
<u>Semivolatiles</u>							
Napthalene	ug/kg	13,000	156	470	239	222	128
Phenanthrene	ug/kg	50,000	156	2,200	145	115	204
Fluoranthene	ug/kg	50,000	156	2,500	187	133	237
Pyrene	ug/kg	50,000	156	1,800	222	127	186
Bis(2-ethylhexyl) phthalate	ug/kg	50,000	156	3,500	511	452	449
Indeno(1,2,3-cd) pyrene	ug/kg	3,200	156	930	1,238	159	169
Benzo(a)anthracene	ug/kg	220 or MDL(5)	156	760	133	74.5	114
Chrysene	ug/kg	400	156	700	217	103	150
Benzo(a)pyrene	ug/kg	61 or MDL(5)	156	860	147	78.2	145
Dibenzo(a,h)anthracene	ug/kg	14 or MDL(5)	156	990	2.37	43.8	114

Notes:

- Soil results, following thermal treatment during the Interim Remedial Measure, prior to backfilling.
Data obtained from International Technology Corp. "Ash Landfill Immediate Response, July 1995".
Total metal concentrations in the treated soil were not analyzed.
- NYSDEC TAGM values based on Technical and Administrative Guidance Memorandum HWR-94-4046, January 24, 1994. The TAGMs are cleanup guidelines and are for comparison.
- 95th Upper Confidence Limit of the mean is a probabilistic estimate of the true site mean. Non-detects were assumed to be at one-half of the detection limit for all statistical calculations.
- Mean is the arithmetic mean, i.e. the sum of the values divided by the number of samples.
- For semivolatile organic compounds the Minimum Detection Limit (MDL) is 330 ug/Kg.

Table 5

SENECA ARMY DEPOT ACTIVITY
ASH LANDFILL OPERABLE UNIT
TOTAL CHLORINATED ETHENES OF GROUNDWATER SAMPLES FOR FOUR SAMPLING EVENTS

Monitoring Well Designation	Location	Total Chlorinated Ethene Concentrations, ug/l			
		Jun-93	Jun-97	Oct-99	Jan-00
MW-12A or PT-12	Plume	2,461	3,570	2,123	2,088
MW-27	North of Impact Area	ND	ND	ND	ND
MW-28	Plume	88	88	47	46
MW-29	Plume	101	157	152	100
MW-30	South of West Smith Farm Road	1	ND	2	1
MW-31	South of West Smith Farm Road	ND	ND	ND	ND
MW-32	South of West Smith Farm Road	ND	ND	ND	ND
MW-33	South of West Smith Farm Road	ND	ND	ND	ND
MW-35D	Off of SEDA facility	ND	ND	ND	ND
MW-37	North of Impact Area	ND	n/a	ND	ND
MW-38D	North of Impact Area	ND	ND	ND	ND
MW-39	Northeast of Impact Area	ND	n/a	ND	ND
MW-40	East of Impact Area	ND	ND	ND	ND
MW-43	East of Impact Area	6	n/a	ND	ND
MW-44 or MW-44A	IRM area	132,360	930	1,104	399
MW-45	North of Impact Area	0.5	ND	ND	ND
MW-46	Plume	167	126	157	80
MW-47	Off of SEDA facility. Upgradient of Farmer's well	ND	ND	ND	n/a
MW-48	North of Impact Area	ND	ND	ND	ND
MW-49D	Plume	n/a	n/a	23	30
MW-50D	Plume	n/a	ND	ND	ND
MW-51D	Off of SEDA facility. Upgradient of Farmer's well	n/a	ND	ND	ND
MW-52D	Off of SEDA facility. Upgradient of Farmer's well	n/a	ND	ND	ND
MW-53	Plume	n/a	55	22	33
MW-54D	Plume	n/a	n/a	2.7	1
MW-55D	Plume	n/a	n/a	ND	ND
MW-56	Off of SEDA facility. Upgradient of Farmer's well	n/a	1.6	ND	ND
MW-57D	Off of SEDA facility. Upgradient of Farmer's well	0.2	n/a	ND	ND
MW-58D	Off of SEDA facility. Upgradient of Farmer's well	n/a	n/a	ND	ND
MW-59	South of West Smith Farm Road	ND	ND	ND	ND
MW-60	South of West Smith Farm Road	ND	ND	ND	ND
PT-11	South of West Smith Farm Road	ND	ND	ND	ND
PT-16	North of Impact Area	ND	ND	ND	ND
PT-17	Plume	233	233	132	177
PT-18 or PT-18A	Plume	13,953	3,014	10,591	392
PT-19	South of West Smith Farm Road	ND	ND	ND	ND
PT-20	Plume	90	90	75	60
PT-21A	Plume	254	17	28	10
PT-22	Plume	n/a	n/a	193	184
PT-23	North of Impact Area	ND	ND	ND	ND
PT-24	Plume	66	147	121	102
PT-25	South of West Smith Farm Road	ND	ND	ND	ND
MWT-1	2.5 ft Upgradient of Existing Wall	n/a	n/a	n/a	116
MWT-4	2.5 ft Upgradient of Existing Wall	n/a	n/a	n/a	79
MWT-7	2.5 ft Upgradient of Existing Wall	n/a	n/a	n/a	410

Notes:

1. Total Chlorinated Ethene means the sum of the concentration of Trichloroethene, Cis-1,2-Dichloroethene, Vinyl Chloride, and Tetrachloroethene
2. Results of Monitoring Wells more than 500 ft away from impact area are not presented in this table
3. ND means that no chlorinated ethenes were detected above the detection limit in the sample collected
4. n/a means that the well was not sampled
5. The higher concentration of a sample and a duplicate is presented in this table

Table 6

**SENECA ARMY DEPOT ACTIVITY
ASH LANDFILL OPERABLE UNIT**

**SOLID WASTE MANAGEMENT UNITS WHERE REMEDIAL
INVESTIGATION/FEASIBILITY STUDY WILL BE OR HAS
BEEN CONDUCTED**

SEAD-4	Munitions Washout Facility Leachfield
SEAD-12	Former Nuclear Weapons Storage Area (WSA)
SEAD-16	Building S-311 Abandoned Deactivation Furnace
SEAD-17	Building 367 Existing Deactivation Furnace
SEAD-23	Open Burning Grounds
SEAD-25	Fire Training and Demonstration Pad
SEAD-26	Fire Training Pit and Area
SEAD-45	Open Detonation Facility
SEAD-3	Ash Landfill
SEAD-6	
SEAD-8	
SEAD-14	
SEAD-15	

Table 7

**SENECA ARMY DEPOT ACTIVITY
ASH LANDFILL OPERABLE UNIT**

Applicable or Relevant and Appropriate Requirements (ARAR) for Soil and Groundwater

	Soil NYSDEC TAGM (1) ug/kg	Groundwater NYSDEC Class GA STANDARD ug/L
Volatile Organic Compounds		
1,1,1-Trichloroethane	800	5
Benzene	60	0.7
Chloroform	300	7
Ethyl benzene	5500	5
Methylene Chloride	100	5
Toluene	1500	5
Xylene (total)	1200	5
Vinyl Chloride	200	2
1,2-Dichloroethene (total)	300	N/A
Cis-1,2-Dichloroethene		5
Trichloroethene	700	5
Semivolatile Organic Compounds		
2-Methylnaphthalene	36400	N/A
Acenaphthylene	41000	N/A
Dibenzofuran	6200	N/A
Phenanthrene	50000	N/A
Benzo(a)anthracene	220 or MDL(2)	N/A
bis(2-Ethylhexyl)phthalate	50000	50
Benzo(b)fluoranthene	1100	N/A
benzo(k)fluoranthene	1100	N/A
Benzo(a)pyrene	61 or MDL(2)	10
Indeno(1,2,3-cd)pyrene	3200	N/A
Dibenz(a,h)anthracene	14 or MDL(2)	N/A
Benzo(g,h,i)perylene	50000	N/A
Pesticides/PCBs		
Aroclor-1260	1000	N/A
Metals		
Cadmium	1.74	10
Chromium	26.49	50
Copper	25	200
Lead	30	25
Zinc	88.89	300

1. NYSDEC TAGM values based on Technical and Administrative Guidance Memorandum HWR-92-4046, January 24, 1994. The TAGMs are soil cleanup guidelines and are for comparison.
2. For semivolatile organic compounds, the Minimum Detection Limit (MDL) is 330 ug/Kg.
3. Class GA groundwater means that the groundwater is suitable for use as a source of potable water.
4. N/A means no standard is available.

**Seneca Army Depot
Ash Landfill
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**Table 8
Summary of Detailed Evaluation of Source Control Options**

Criteria	Alternative SC-1 No Action	Alternative SC-2 Excavate Ash Landfill and NCFL Dispose in Off-site Subtitle D Landfill	Alternative SC-3 Excavation/Consolidation to On-site Landfill/Cap	Alternative SC-4 Excavation/Soil Washing/ Solidify Fines/Cap	Alternative SC-5 Excavation of Debris Piles/ Off-Site Subtitle D Landfill
<p>OVERALL PROTECTIVENESS OF HUMAN HEALTH AND THE ENVIRONMENT</p> <p>Human Health Protection (EPA target range is 1×10^{-4} to 1×10^{-6} for carcinogenic risk and an HI < 1.0 for noncarcinogenic risk)</p> <p>Exposure Pathways Include: Ingestion of Groundwater Dermal Contact Inhalation of Volatile Organics Ingestion of Soils (Future On-site hunter and construction worker only)</p> <p>Protection of Ecological Receptors</p>	<p>Sum of risks to current off-site resident, future on-site hunter and future on-site construction worker $2.9 \text{ E-}05$ HI = 0.22</p> <p>Protective for Humans due to exposure to soils; IRM has eliminated risk due to VOCs in soil.</p> <p>Not protective for ecological; Metals remain in-place.</p>	<p>Sum of risks to current off-site resident, future on-site hunter and future on-site construction worker $2.87\text{E-}005$ HI = 0.1911</p> <p>Protective of human health; dependant on landfill maintenance</p> <p>Protects ecological receptors; Sediments > NYSDEC Criteria removed from Ash Landfill area.</p>	<p>Sum of risks to current off-site resident, future on-site hunter and future on-site construction worker $2.87\text{E-}005$ HI = 0.1911</p> <p>Protective of human health; dependant on landfill maintenance</p> <p>Protects ecological receptors; Sediments > NYSDEC Criteria removed from Ash Landfill area.</p>	<p>Sum of risks to current off-site resident, future on-site hunter and future on-site construction worker $2.83\text{E-}005$ HI = 0.1934</p> <p>Protective of human health; Soils > NYSDEC Criteria excavated, washed, fines solidified</p> <p>Protects ecological receptors; Sediments > NYSDEC Criteria excavated, washed, fines solidified</p>	<p>Sum of risks to current off-site resident, future on-site hunter and future on-site construction worker $2.87\text{E-}005$ HI = 0.1911</p> <p>Protective of human health; dependent on landfill maintenance</p> <p>Protects ecological receptors; Sediments > NYSDEC Criteria removed from Ash Landfill area.</p>
COMPLIANCE WITH ARARs	Will comply with all ARARs	Will comply with all ARARs	Will comply with all ARARs	Will comply with all ARARs	Will comply with all ARARs
<p>LONG-TERM EFFECTIVENESS AND PERMANENCE</p> <p>Magnitude of Residual Risk</p> <p>Permanence</p>	<p>Sources have not been removed. Potential threat will remain.</p> <p>Not a permanent solution.</p>	<p>No residual risk will exist , all materials will be removed.</p> <p>Once soils are placed in the off-site landfill, the remedial action would be permanent.</p>	<p>No residual risk will exist , providing landfill does not leak.</p> <p>Once soils are placed in the on-site landfill, the remedial action would be permanent, provided cap integrity is maintained.</p>	<p>Treatment residuals consisting of coarse fraction will remain on-site but will be tested to assure that no unacceptable levels contamination. Fines solidified to render unreactive</p> <p>Upon completion this action will be considered permanent.</p>	<p>No residual risk will exist providing maintenance of cover integrity. Also, the Debris Piles will be disposed of off-site.</p> <p>Once soils are placed in the off-site landfill, the remedial action would be permanent, provided cap integrity is maintained.</p>

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Ash Landfill
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**Table 8
Summary of Detailed Evaluation of Source Control Options**

Criteria	Alternative SC-1 No Action	Alternative SC-2 Excavate Ash Landfill and NCFL Dispose in Off-site Subtitle D Landfill	Alternative SC-3 Excavation/Consolidation to On-site Landfill/Cap	Alternative SC-4 Excavation/Soil Washing/ Solidify Fines/Cap	Alternative Sc-5 Excavation of Debris Piles/ Off-Site Subtitle D Landfill
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT					
Reduction of Toxicity, Mobility, or Volume	Little to none; The Army believes that some attenuation is expected due to natural mechanisms.	Very effective in reducing mobility; no effect on toxicity or volume of contaminated soils.	Very effective in reducing mobility; no effect on toxicity or volume of contaminated soils.	Very effective in reducing volume, toxicity, and mobility. Solidification reduces toxicity and mobility. Soil washing reduces the volume.	Very effective in reducing mobility; no effect on toxicity or volume of contaminated soils.
SHORT-TERM EFFECTIVENESS					
Community Protection	Most protective under current conditions as current risk is within acceptable ranges.	Least protective as large volume of contaminated soils is excavated. Dust and truck traffic is threat, transported on-site for disposal.	Most protective of remedial actions as no transportation of waste materials off-site will occur. Some dust will be produced during filling and construction of landfill.	Least protective as large volume of contaminated soils is required. Hazardous materials (acids) may be transported on-site for extraction.	Moderately protective as transportation of waste materials off-site will occur.
Worker Protection	Not applicable.	Least protective ; Excavation and off-site transportation of waste materials increase potential for worker exposure and risk.	Most protective of remedial actions as no transportation of waste materials off-site will occur. Some dust will be produced during filling and construction of landfill. Protection required from exposure.	Least protective ; Excavation and off-site transportation of waste materials increase potential for worker exposure and risk. Use of hazardous materials will also increase potential for worker exposure.	Moderately protective ; Excavation and off-site transportation of waste materials increase potential for worker exposure and risk.
Environmental Impacts	Not applicable.	Least protective due to disruption from excavation. Restoration will require year before site is fully restored.	Excavation will increase potential for dispersion of contaminated soil	Least protective due to increased potential for spills during washing.	Excavation will increase potential for dispersion of contaminated soil
Time Until Action is Complete	Not applicable	Remdial action: 12 to 18 months	Remdial action: 4 to 6 months	Mob. & Prove-out: 1 to 2 months Soil Washing: 1 to 3 months Backfilling & Demob.: 1month. Moderate time required to attain goals, due to soil washing process rate.	Remediation action: 4 to 6 months.

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**Table 8
Summary of Detailed Evaluation of Source Control Options**

Criteria	Alternative SC-1 No Action	Alternative SC-2 Excavate Ash Landfill and NCFL Dispose in Off-site Subtitle D Landfill	Alternative SC-3 Excavation/Consolidation to On-site Landfill/Cap	Alternative SC-4 Excavation/Soil Washing/ Solidify Fines/Cap	Alternative SC-5 Excavation of Debris Piles/ Off-Site Subtitle D Landfill
IMPLEMENTABILITY					
Technical Feasibility	Not applicable.	Very feasible; area with VOC has been remediated. Equipment required for excavation is standard.	Very feasible; area with VOC has been remediated. Equipment required for excavation is standard.	Soil washing is feasible but least feasible of the four remedial actions as this technology is considered the most innovative and least proven for Ash landfill conditions.	Very feasible; area with VOC has been remediated. Equipment required for excavation is standard.
Ease of Doing More Action if Needed	Least interference, as nothing would be done to prevent required future action.	Little to no interference, site conditions would be restored to original condition.	Most interference as on-site landfill will hamper any future actions.	Moderate level of interference as some equipment slabs and roadways may interfere with future actions. Solidified fines mass fairly permanent.	Least level of interference as Debris Piles will be removed and NCFL and Landfill will be covered.
Ability to Obtain Approvals and Coordinates with Other Agencies	No approval necessary	Landfill space is available locally, permitted landfills will accept waste.	Cap technology considered a temporary solution by the EPA.	Moderately likely to be approved as this alternative will involve the construction of a waste treatment facility.	Landfill space is abundant in the region. Permitting will not be req. providing the waste meets the requirements of the landfill. Standard bill of lading required to transport waste materials to facility. Most likely to be approved.
Availability of Services and Materials	No services or capacities required	Moderately available, requires large amount of trucks and excavators, limited amount of equipment available	Moderately available, requires specialized materials and installation contractors.	Least available, as technology is available from small, specialized group of soil washing contractors.	Very available; Subtitle D landfills located nearby.
COST					
Capital Cost	\$0	\$17.5 Million	\$1.37 Million	\$31.50 Million	\$240,000
Annual O&M Cost	\$0	\$0	\$52,000	\$52,000	\$52,000
30 Year Present Worth O&M Cost	\$0	\$0	\$490,000	\$490,000	\$490,000
30 Year Present Worth Cost	\$0	\$17.5 Million	\$1.89 Million	\$32.00 Million	\$730,000

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**Table 9
Summary of Detailed Evaluation of Migration Control Options**

Criteria	Alternative MC-1 No Action	Alternative MC-2 Alternate Water Source with Natural Attenuation of Plume	Alternative MC-3/MC-3a Air Sparging of Plume/ Funnel and Gate with Zero Valence Iron	Alternative MC-5 Collection/Filtration/Air Stripping/Discharge	Alternative MC-6 Collection/Filtration/ UV Oxidation/Discharge
<p>PROTECTIVENESS OF HUMAN HEALTH AND THE ENVIRONMENT</p> <p>Human Health Protection (EPA target range is 1×10^{-4} to 1×10^{-6} for carcinogenic risk and an HI < 1.0 for noncarcinogenic risk)</p> <p>Exposure Pathways Include : Ingestion of Groundwater Dermal Contact Inhalation of Volatile Organics Ingestion of Soils (Future On-site hunter and construction worker only)</p> <p>Protection of Ecological Receptors</p>	<p>Sum of risks to current off-site resident, future on-site hunter and future on-site construction worker $2.9E-05$ HI = 0.22</p> <p>Not Protective; Ingestion of groundwater at site boundary could result in exposure</p> <p>Protective; Depth to groundwater prevents ecological exposure; natural mechanisms reduces conc.</p>	<p>Sum of risks remaining to off-site resident, hunter & construction worker following elimination of groundwater exposure $2.9E-05 - 5.6E-06 = 2.34E-05$ HI = $(0.22 - 0.14 = 0.08)$</p> <p>Protective; Alternative water supply eliminates exposure to groundwater.</p> <p>Protective; Depth to groundwater prevents ecological exposure; Natural mechanisms reduces conc.</p>	<p>Sum of risks remaining to off-site resident, hunter & construction worker following elimination of groundwater exposure $2.9E-05 - 5.6E-06 = 2.34E-05$ HI = $(0.22 - 0.14 = 0.08)$</p> <p>Protective; Groundwater exposure is eliminated.</p> <p>Protective; No Exposure from groundwater</p>	<p>Sum of risks remaining following elimination of groundwater as an exposure pathway $2.9E-05 - 5.6E-06 = 2.34E-05$ HI = $(0.22 - 0.14 = 0.08)$</p> <p>Protective; Groundwater exposure is eliminated.</p> <p>Protective; Conc. of groundwater is reduced prior to discharge</p>	<p>Sum of risks remaining following elimination of groundwater as an exposure pathway $2.9E-05 - 5.6E-06 = 2.34E-05$ HI = $(0.22 - 0.14 = 0.08)$</p> <p>Protective; Groundwater exposure is eliminated.</p> <p>Protective; Conc. of groundwater is reduced prior to discharge</p>
COMPLIANCE WITH ARARs	Not Compliant with ARARs	Not Compliant with ARARs	Will comply with all ARARs	Will comply with all ARARs	Will comply with all ARARs
<p>LONG-TERM EFFECTIVENESS AND PERMANENCE</p> <p>Magnitude of Residual Risk</p> <p>Permanence</p>	<p>Source of VOCs have been removed. On-site risk is above target range, if water is ingested. Off-site migration can lead to unacceptable risk.</p> <p>Will be permanent once natural mechanisms reduce conc. to State and Federal criteria.</p>	<p>Source of VOCs have been removed. On-site risk is above target range, if water is ingested. Off-site risk is controlled by providing a water supply.</p> <p>Will be permanent once natural mechanisms reduce conc. to State and Federal criteria.</p>	<p>No residual risk will exist, groundwater will be treated until it meets treatment criteria.</p> <p>Once State and Federal groundwater quality criteria is attained the action is permanent.</p>	<p>No residual risk will exist, groundwater will be treated until it meets treatment criteria.</p> <p>Once State and Federal groundwater quality criteria is attained the action is permanent.</p>	<p>No residual risk will exist, groundwater will be treated until it meets treatment criteria.</p> <p>Once State and Federal groundwater quality criteria is attained the action is permanent.</p>

Seneca Army Depot
Ash Landfill
Proposed Remedial Action Plan

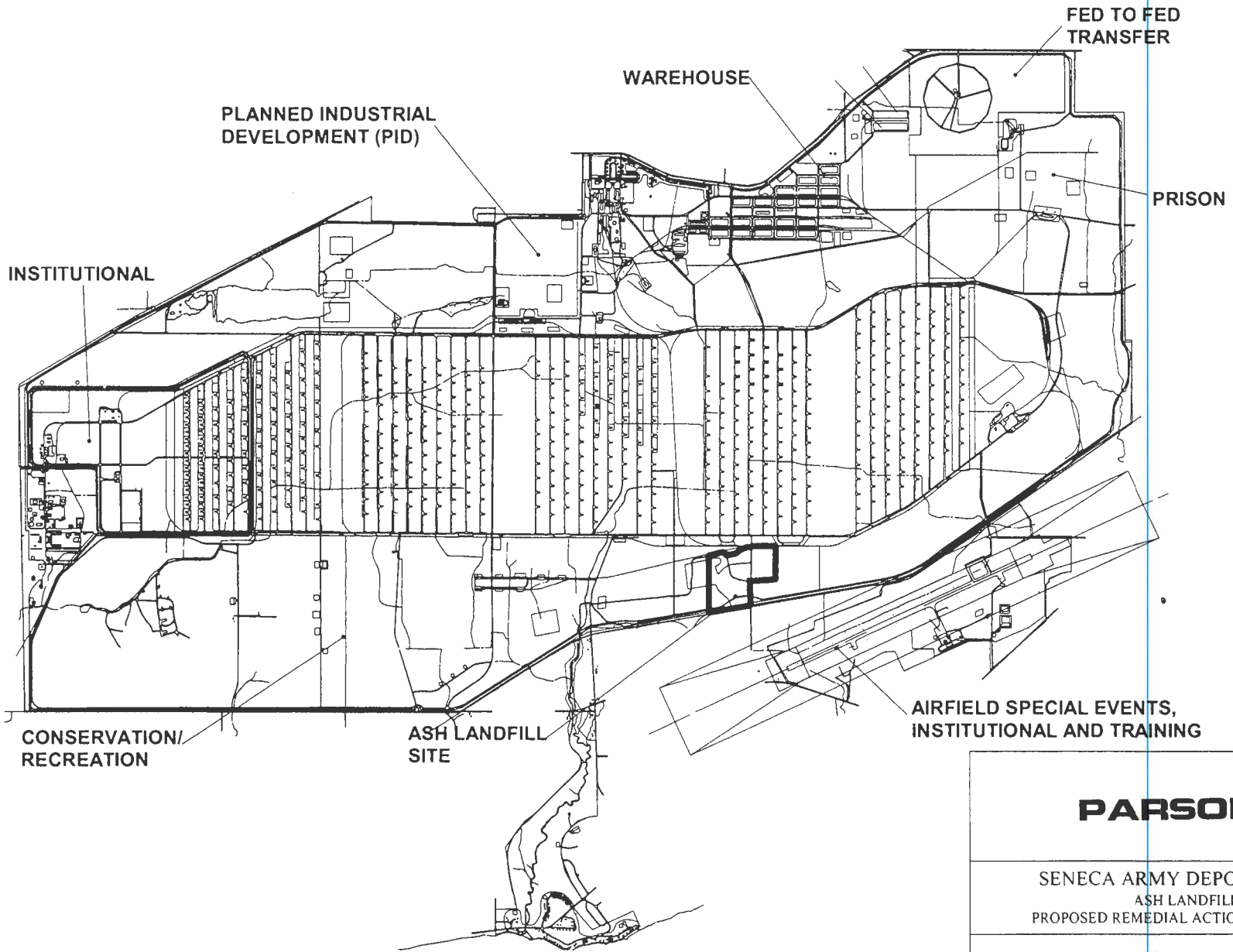
Table 9
Summary of Detailed Evaluation of Migration Control Options

Criteria	Alternative MC-1 No Action	Alternative MC-2 Alternate Water Source with Natural Attenuation of Plume	Alternative MC-3/MC-3a Air Sparging of Plume/ Funnel and Gate with Zero Valence Iron	Alternative MC-5 Collection/Filtration/Air Stripping/Discharge	Alternative MC-6 Collection/Filtration/ UV Oxidation/Discharge
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT Reduction of Toxicity, Mobility, or Volume	Biodegradation and attenuation will not be efficient to prevent migration and increase the volume of contaminated groundwater. The breakdown product vinyl chloride is a toxic by-product of 1,2-DCE. Vinyl chloride is more mobile than the parent compound.	Biodegradation and attenuation will not be efficient to prevent migration. The breakdown product vinyl chloride is a toxic by-product of 1,2-DCE. Vinyl chloride is more mobile than the parent compound. Documentation of migration will be monitored to prevent volume increase	Effective; Constituents are removed or destroyed	Effective; Constituents are removed, trenches will eliminate mobility.	Effective; Constituents are destroyed, trenches will eliminate mobility.
SHORT-TERM EFFECTIVENESS					
Community Protection	Protective under current conditions as current risk is within acceptable ranges.	Protective under current conditions as current risk is within acceptable ranges.	Protective of community; air emissions from sparging eliminated via carbon, will comply with air quality standards.	Protective of community; air emissions from stripping eliminated via carbon, will comply with air quality standards.	Protective of community; No air emissions produced, will comply with air quality standards.
Worker Protection	Protective under current conditions as current risk is within acceptable ranges.	Protective under current conditions as current risk is within acceptable ranges.	Dust produced during construction will be eliminated via personnel protective equipment.	Dust produced during construction will be eliminated via personnel protective equipment.	Dust produced during construction will be eliminated via personnel protective equipment.
Environmental Impacts	Current, short-term, conditions are protective of the environment.	Current, short-term, conditions are protective of the environment.	Protective; Any soil excavated will not contain hazardous constituents.	Protective; Any soil excavated will not contain hazardous constituents.	Protective; Any soil excavated will not contain hazardous constituents.
Time Until Action is Complete	Not Applicable; No action is performed	Estimated to be 45 years with a degradation rate of 0.0003/day	Estimated to be 30 years for sparging; estimated to be 30 years with funnel and gate system, and 15 years with permeable walls.	Estimated to be 30 years with three trenches	Estimated to be 30 years with three trenches

Seneca Army Depot
Ash Landfill
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Table 9
Summary of Detailed Evaluation of Migration Control Options

Criteria	Alternative MC-1 No Action	Alternative MC-2 Alternate Water Source with Natural Attenuation of Plume	Alternative MC-3/MC-3a Air Sparging of Plume/ Funnel and Gate with Zero Valence Iron	Alternative MC-5 Collection/Filtration/Air Stripping/Discharge	Alternative MC-6 Collection/Filtration/ UV Oxidation/Discharge
IMPLEMENTABILITY					
Technical Feasibility	Feasible, Nothing is implemented	Feasible, water line can be installed; Natural mechanisms may be degrading pollutants. Degradation may attain acceptable levels. Monitoring will ensure protection.	Feasible; Some uncertainty as zero valence iron is innovative; will require treatability/pilot testing	Feasible; Air stripping is a proven technology for VOC removal in groundwater.	Feasible; UV oxidation is a proven tech. for chlorinated VOCs in groundwater.
Ease of Doing More Action if Needed	Not Applicable; as nothing would be performed in the future	Least interference, as nothing would be done to prevent required future action.	This technology will not interfere with any other remedial activities.	Will not interfere with other remedial activities.	Will not interfere with other remedial activities.
Ability to Obtain Approvals and Coordinates with Other Agencies	No Action will be unacceptable to regulatory agencies due to off-site migration	Will require approval for waterline construction from town and the Dept. of Health.	NYSDEC and EPA input required prior to final remedy selection. Regulatory issues will be addressed.	Construction permits are readily attainable.	Construction permits are readily attainable.
Availability of Services and Materials	No services required	All services required to install waterline and monitor the plume are readily available.	Material and Services are available. All equipment required is standard	Materials and Services are readily available. All equipment is standard.	Materials and Services are specialized; not as available UV equipment is specialized.
COST					
Capital Cost	\$0	\$160,000 includes installation of 10 MWs and 4800 l.f. of 6" water main	MC-3 \$668,000 MC-3a \$2.05 Million	\$543,000	\$556,000
Annual O&M Cost	\$0	\$84,000	MC-3 \$99,000 MC-3a \$86,000	\$114,309	\$119,546
Operating Life in Years	0	30	30 yr. for MC-3 and 15 yr. for MC-3a	30	30
Operating Life Present Worth O&M Cost	\$0	\$794,500	MC-3 \$1.79 Million MC-3a \$656,000 MC-3a \$813,000 assuming 30 years	\$1.22 Million	1.31 Million
Total Present Worth Cost (Assumes 10% Interest)	\$0	30 year Cost \$954,500	30 year Cost MC-3 \$2.50 Million 15 year Cost MC-3a \$2.71 Million 30 year Cost MC-3a \$2.86 Million	30 year Cost \$1.76 Million	30 year Cost \$1.86 Million



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

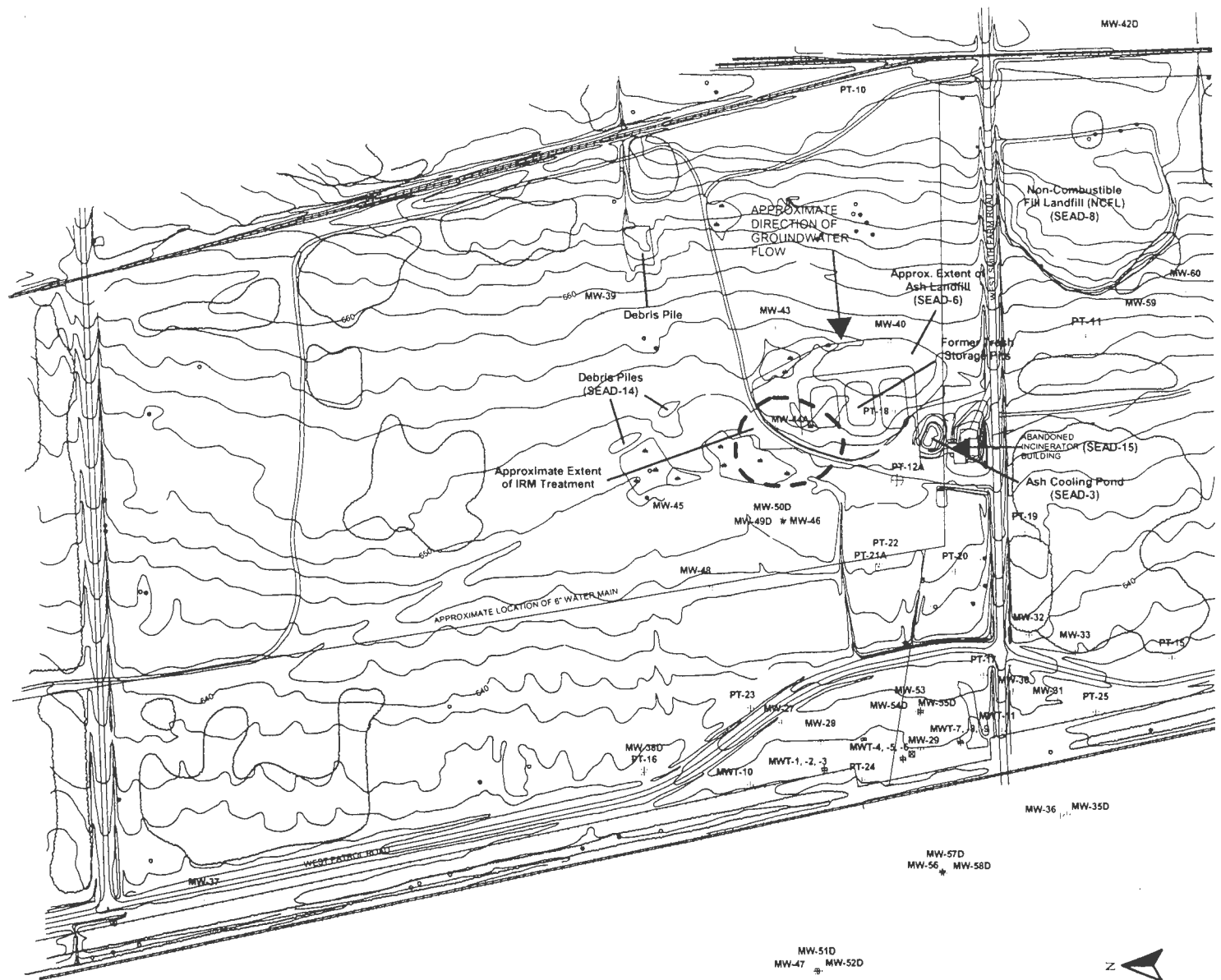
FIGURE 1
 ASH LANDFILL LOCATION
 AND PROPOSED LAND REUSE AREAS

NOT TO SCALE

JULY 2001

LEGEND

- PAVED ROAD
- GROUNDWATER AND ELEVATION
- WETLAND
- OUTLINE OF FORMER TRANSPIRATION SUBSID FROM AERIAL PHOTO
- APPROXIMATE EXTENT OF DEBRIS PILE
- BRUSH
- CHAIN LINK FENCE
- UTILITY POLE
- APPROXIMATE LOCATION OF FIRE HYDRANT
- MONITORING WELL AND DESIGNATION
- RAILROAD
- 6" WATER MAIN
- APPROXIMATE EXTENT OF IRM TREATMENT



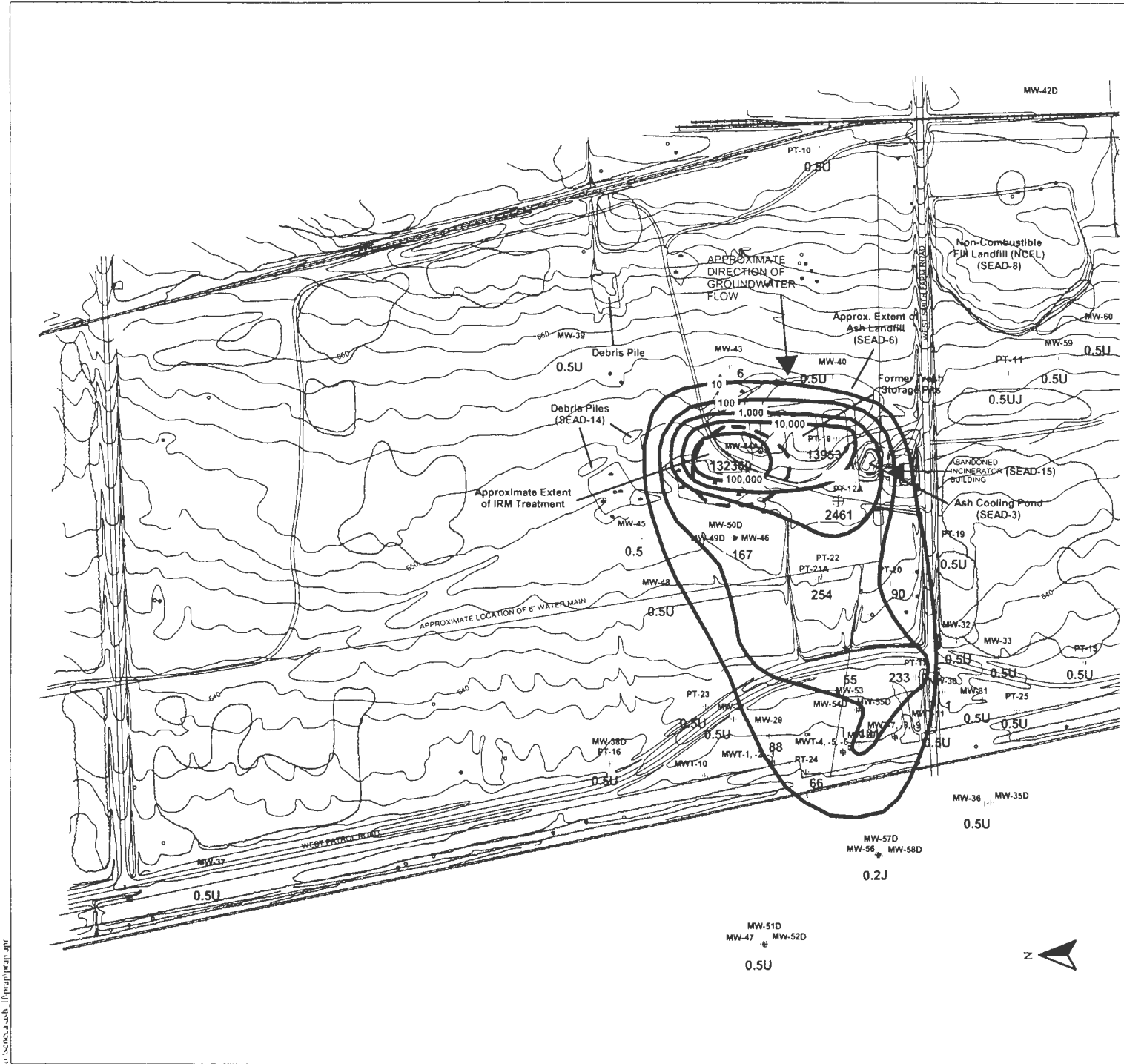
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SENECA ARMY DEPOT ACTIVITY
ASH LANDFILL
PROPOSED REMEDIAL ACTION PLAN (PRAP)

FIGURE 2
ASH LANDFILL
SITE MAP

SCALE: 1" = 400' JULY 2001

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LEGEND

- PAVED ROAD
- GROUNDWATER AND LITHATION
- WELL AND
- OUTLINE OF FORMER TRASH PILES (WITH DROM ARIUM PHOTO)
- APPROXIMATE EXTENT OF DEBRIS PILE
- DEBRIS
- CHAIN LINK FENCE UTILITY POLE
- APPROXIMATE LOCATION OF FIRE HYDRANT
- MONITORING WELL AND INDICATION
- RAILROAD
- 6" WATER MAIN
- APPROX. EXTENT OF IRM SOIL TREATMENT
- GROUNDWATER ISOCONTOUR (ug/L)
- 1,000 TOTAL CHLORINATED ETHENES (ug/L) FROM SAMPLES COLLECTED IN JUNE 1993
- 75 NO CHLORINATED ETHENES DETECTED (HIGHEST INDIVIDUAL CHLORINATED ETHENE DETECTION LIMIT IS SHOWN)
- 0.5U ESTIMATED VALUE
- 0.5J ESTIMATED DETECTION LIMIT

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

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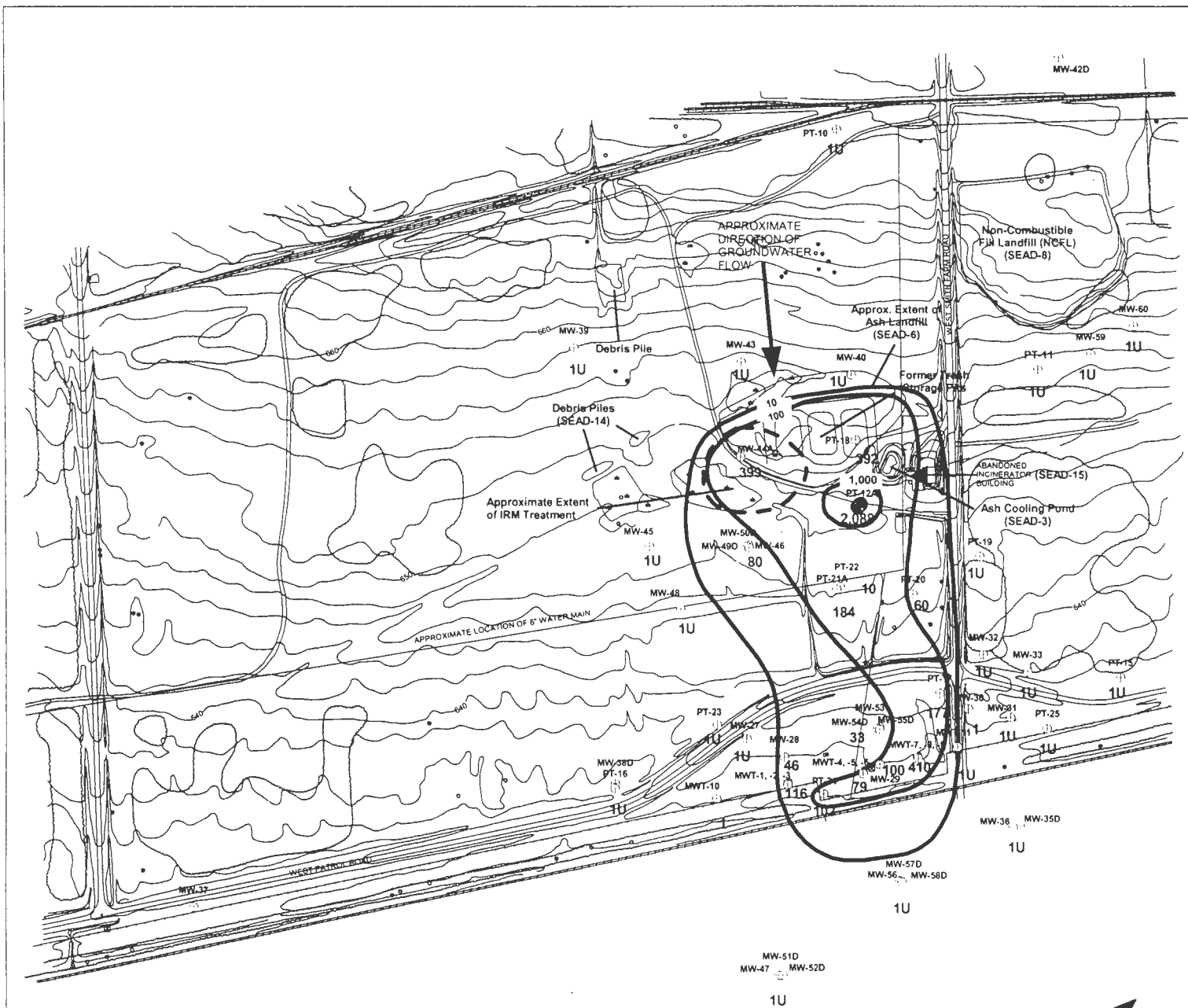
SENECA ARMY DEPOT ACTIVITY
ASH LANDFILL
PROPOSED REMEDIAL ACTION PLAN (PRAP)

FIGURE 3
TOTAL CHLORINATED ETHENES
IN GROUNDWATER
PRE-IRM PLUME

SCALE: 1" = 400' JULY 2001

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LEGEND

- PAVED ROAD
- GROUNDWATER AND ELEVATION
- WETLAND
- OUTLINE OF FORMER TRASH PITS (IDENTIFIED FROM AERIAL PHOTO)
- APPROXIMATE EXTENT OF DEBRIS PILE
- BRUSH
- CHAINLINK FENCE
- UTILITY POLE
- APPROXIMATE LOCATION OF VALVE OF FIRE HYDRANT
- MONITORING WELL AND SIGNATION
- RAILROAD
- 6" WATER MAIN
- APPROX. EXTENT OF IRM SOIL TREATMENT
- GROUNDWATER ISOCOUNTOUR (ug/L)
- 1,000
- 75
- 10U

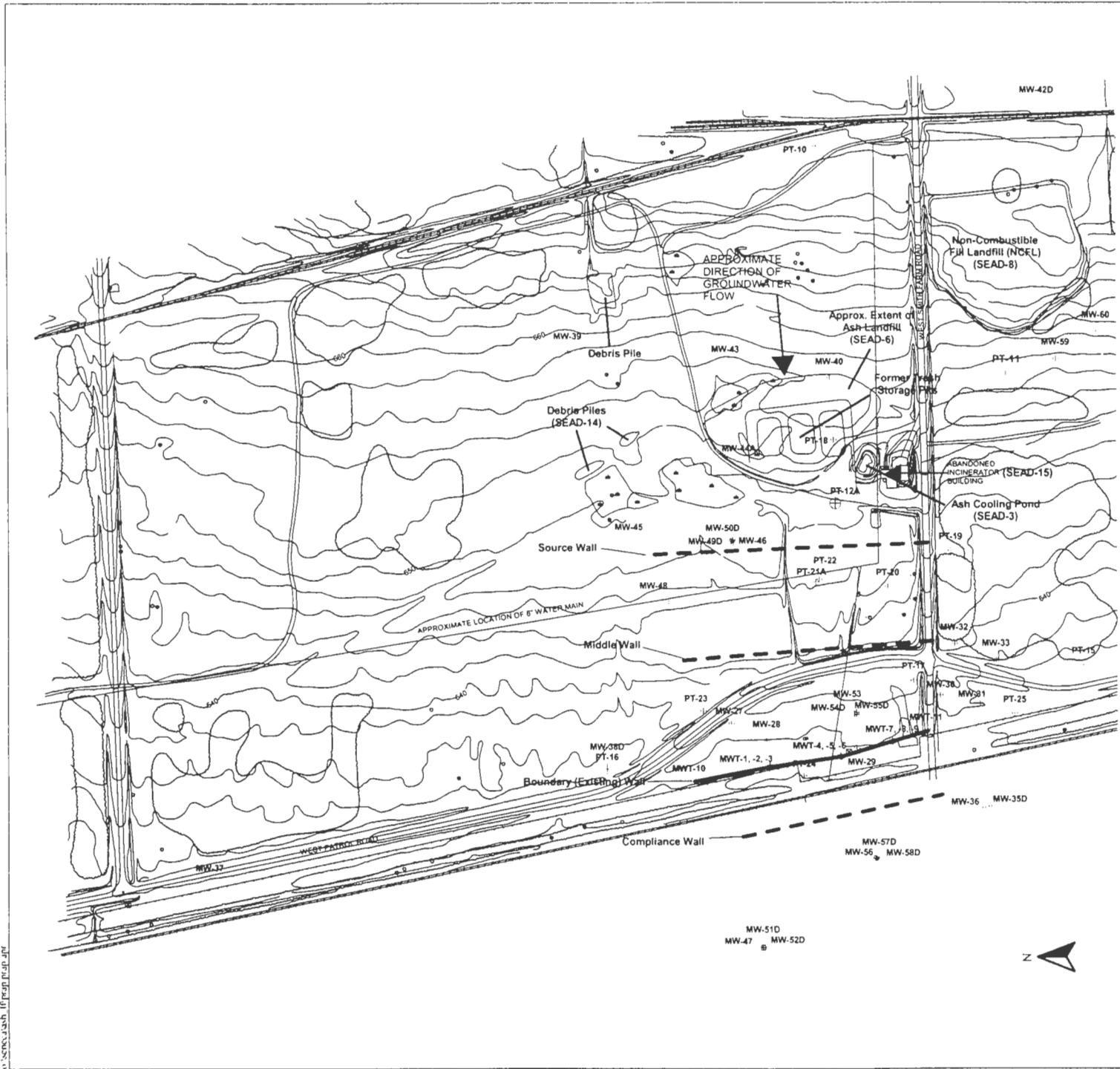
NOTE:
THE CONCENTRATIONS SHOWN ON THIS FIGURE ARE FOR WELLS SCREENED IN THE TILLED WEATHERED SHALE AQUIFER

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

FIGURE 4
TOTAL CHLORINATED ETHENES
IN GROUNDWATER
MOST RECENT CONCENTRATIONS

SCALE: 1" = 400' JULY 2001



- LEGEND**
- PAVED ROAD
 - GROUND CONTOUR AND ELEVATION
 - WETLAND
 - LINE OF FORMER TRASH PILE IDENTIFIED FROM AERIAL PHOTO
 - APPROXIMATE EXTENT OF DEBRIS PILE
 - DEBRIS PILE
 - CHAIN LINK FENCE
 - UTILITY POLE
 - APPROXIMATE LOCATION OF FIRE HYDRANT
 - MONITORING WELL AND DESIGNATION
 - RAILROAD
 - 6" WATER MAIN
 - PROPOSED TREATMENT WALL
 - EXISTING TREATMENT WALL

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ASH LANDFILL
PROPOSED REMEDIAL ACTION PLAN (PRAP)

FIGURE 5
EXISTING AND PROPOSED
REACTIVE BARRIER WALL TRENCHES

SCALE: 1" = 400' JULY 2001

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FAX HEADER

SENECA ARMY DEPOT ACTIVITY
CARETAKER FORCE
PO BOX 9
ROMULUS, NY 14541

TO: See Distribution

phone: _____
fax: _____

From: Nancy Williamson
Facilities Assistant
phone: (607) 869-1494
fax: (607) 869-1362
email: williamsonn@seneca-hq.army.mil

Regarding: _____
Ash Landfill
Doc's

Nancy
Please FAX to
Todd, Kevin Randy
file -

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FAX HEADER

SENECA ARMY DEPOT ACTIVITY
CARETAKER FORCE
PO BOX 9
ROMULUS, NY 14541

TO: See Description

phone: _____

fax: _____

Regarding: _____

From:

Nancy Williamson

Facilities Assistant

phone:

(607) 869-1494

fax:

(607) 869-1362

email:

williamsonn@seneca-hq.army.mil

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*Nancy
Please Fax to
Todd, Kevin
Randy
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