**PARSONS ENGINEERING SCIENCE, INC.**

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

File

SI-02 ASH LF TREAT STUDY

January 5, 2000

Mr. Stephen Absolom
BRAC Environmental Coordinator
ATTN: SIOSE-BEC
Building 123
Seneca Army Depot Activity
Romulus, New York 14541-5001

**SUBJECT:** **Ash Landfill Reactive Wall Treatability Study**
**Quarterly Groundwater Sampling Results**
**Seneca Army Depot Activity, Romulus, New York**

Dear Mr. Absolom:

In accordance with Paragraph 24.2 of the Federal Facilities Agreement for this project, Parsons Engineering Science (Parsons) is pleased to submit the results of the initial three rounds of groundwater monitoring, which have been conducted as part of the Ash Landfill Reactive Wall Treatability Study. The treatability study will include four quarters of groundwater monitoring data and monthly water level measurements for one year. The first quarter of groundwater monitoring for the Ash Landfill Treatability Study was conducted between April 26 through 28, 1999; the second quarter was conducted on June 29, 1999; and the third quarter was conducted between September 28 and 29, 1999. This data has been validated.

In addition, water level measurements were performed monthly at 18 monitoring wells at the Ash Landfill site. **Figure 1** shows the locations of the monitoring wells. These monitoring wells include the 11 monitoring wells associated with the reactive iron wall and six additional monitoring wells located upgradient of the wall and one monitoring well located just downgradient of the wall. The groundwater elevation measurements are summarized in **Table 1**.

Groundwater samples were collected from 11 monitoring wells. The groundwater samples were analyzed for TCL VOCs, calcium, iron, magnesium, manganese, potassium, and the following indicator parameters: TDS, methane/ethane/ethene, nitrate/nitrite, alkalinity, sulfate, chloride, ferrous iron, and phosphate. All monitoring wells were sampled using the EPA Region II Low-Flow Groundwater Sampling Procedures. **Tables 2 through 4** summarize the validated analytical results.

One additional, final round of groundwater monitoring is being completed this week and will be submitted to you along with the previous data, provided to you herein, as part of the final treatability study report.

Parsons appreciates the opportunity to provide you with this data. Should you have any questions, please do not hesitate to call me at (782) 401-2492 to discuss them.

Sincerely,

**PARSONS ENGINEERING SCIENCE, INC.**

Eliza Schacht for
Michael Duchesneau, P.E.
Project Manager

cc: Dorothy Richards, CEHND-PM-ND
Randall Battaglia, CENAN
Keith Hoddinott, USACHPPM (PROV.)
John Buck, AEC
Don Williams, CEMRD
Julio Vazquez, USEPA
James Quinn, NYSDEC

**PARSONS ENGINEERING SCIENCE, INC.**

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

January 5, 2000

Mr. Julio Vazquez
U.S. Environmental Protection Agency, Region II
Emergency & Remedial Response Division
290 Broadway, 18th Floor, E-3
New York, NY 10007-1866

Mr. James Quinn
Bureau of Eastern Remedial Action
Division of Hazardous Waste Remediation
New York State Department of Environmental Conservation (NYSDEC)
Room 208
50 Wolf Road
Albany, NY 12233-7010

**SUBJECT: Ash Landfill Reactive Wall Treatability Study
Quarterly Groundwater Sampling Results
Seneca Army Depot Activity, Romulus, New York**

Dear Mr. Vazquez/Mr. Quinn:

In accordance with Paragraph 24.2 of the Federal Facilities Agreement for this project, Parsons Engineering Science (Parsons) is pleased to submit the results of the initial three rounds of groundwater monitoring, which have been conducted as part of the Ash Landfill Reactive Wall Treatability Study. The treatability study will include four quarters of groundwater monitoring data and monthly water level measurements for one year. The first quarter of groundwater monitoring for the Ash Landfill Treatability Study was conducted between April 26 through 28, 1999; the second quarter was conducted on June 29, 1999; and the third quarter was conducted between September 28 and 29, 1999. This data has been validated.

In addition, water level measurements were performed monthly at 18 monitoring wells at the Ash Landfill site. **Figure 1** shows the locations of the monitoring wells. These monitoring wells include the 11 monitoring wells associated with the reactive iron wall and six additional monitoring wells located upgradient of the wall and one monitoring well located just downgradient of the wall. The groundwater elevation measurements are summarized in **Table 1**.

Groundwater samples were collected from 11 monitoring wells. The groundwater samples were analyzed for TCL VOCs, calcium, iron, magnesium, manganese, potassium, and the following indicator parameters: TDS, methane/ethane/ethene, nitrate/nitrite, alkalinity, sulfate, chloride, ferrous iron, and phosphate. All monitoring wells were sampled using the EPA Region II Low-Flow Groundwater Sampling Procedures. **Tables 2 through 4** summarize the validated analytical results.

One additional, final round of groundwater monitoring is being completed this week and will be submitted to you along with the previous data, provided to you herein, as part of the final treatability study report.

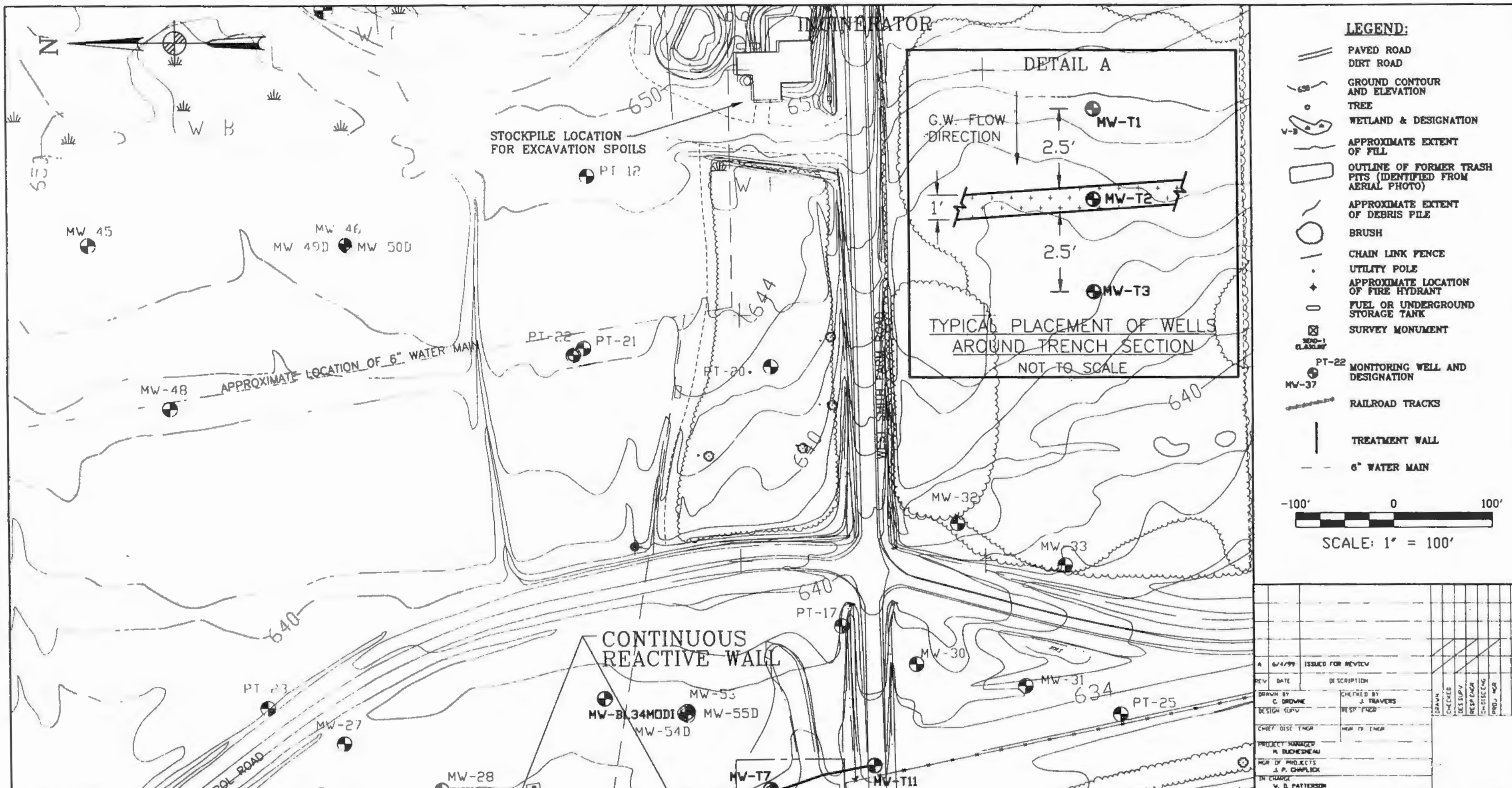
Parsons appreciates the opportunity to provide you with this data. Should you have any questions, please do not hesitate to call me at (782) 401-2492 to discuss them.

Sincerely,

**PARSONS ENGINEERING SCIENCE, INC.**

Eliza Schacht for
Michael Duchesneau, P.E.
Project Manager

cc: Dorothy Richards, CEHND-PM-ND
Randall Battaglia, CENAN
Keith Hoddinott, USACHPPM (PROV.)
John Buck, AEC
Don Williams, CEMRD
Stephen Absolom, SEDA




| REV | DATE | DESCRIPTION |
|---|---|---|
| A | 6/4/99 | ISSUED FOR REVIEW |

DRAWN BY: C. BROWNE
CHECKED BY: J. TRAVERS
PROJECT MANAGER: M. DUCHESNEAU
MGR OF PROJECTS: J. P. CHAPLICK
IN CHARGE: V. B. PATTERSON

PARSONS
PARSONS ENGINEERING SCIENCE, INC.

CLIENT/PROJECT TITLE
**SENECA ARMY DEPOT ACTIVITY**
ASH LANDFILL GROUNDWATER TREATABILITY STUDY USING ZERO VALENT IRON CONTINUOUS REACTIVE WALL

DEPT: ENVIRONMENTAL ENGINEERING
DWG. No.: 729909-01004

**FIGURE 1**
MONITORING WELL LOCATIONS FOR CONTINUOUS REACTIVE WALL

SCALE: 1" = 100' DATE: JUNE 1999 REV: A

Table 1
Seneca Army Depot Activity
Ash Landfill Treatibility Study
Groundwater Elevations - Monthly Measurements

| Monitoring Well | Elevation at Top of Riser (MSL) | April 28, 1999 | | May 28, 1999 | | June 28, 1999 | | July 29, 1999 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Depth from Top of Riser (ft) | Elevation of Water Level (ft) | Depth from Top of Riser (ft) | Elevation of Water Level (ft) | Depth from Top of Riser (ft) | Elevation of Water Level (ft) | Depth from Top of Riser (ft) | Elevation of Water Level (ft) |
| MWT-1 | 637.24 | 5.99 | 631.25 | 5.50 | 631.74 | 6.37 | 630.87 | 8.06 | 629.18 |
| MWT-2 | 637.19 | 5.00 | 632.19 | 5.42 | 631.77 | 6.35 | 630.84 | 8.06 | 629.13 |
| MWT-3 | 637.31 | 5.13 | 632.18 | 5.40 | 631.91 | 6.45 | 630.86 | 8.16 | 629.15 |
| MWT-4 | 637.68 | 5.46 | 632.22 | 6.40 | 631.28 | 8.20 | 629.48 | 10.29 | 627.39 |
| MWT-5 | 637.72 | 5.55 | 632.17 | 6.54 | 631.18 | 8.25 | 629.47 | 10.34 | 627.38 |
| MWT-6 | 637.59 | 5.42 | 632.17 | 6.39 | 631.20 | 8.15 | 629.44 | 10.24 | 627.35 |
| MWT-7 | 638.34 | 6.10 | 632.24 | 7.25 | 631.09 | 9.58 | 628.76 | 11.77 | 626.57 |
| MWT-8 | 638.4 | 6.17 | 632.23 | 7.37 | 631.03 | 9.68 | 628.72 | 11.87 | 626.53 |
| MWT-9 | 638.08 | 5.91 | 632.17 | 7.97 | 630.11 | 9.45 | 628.63 | 11.65 | 626.43 |
| MWT-10 | 636.07 | 6.86 | 629.21 | 4.25 | 631.82 | 5.09 | 630.98 | 6.40 | 629.67 |
| MWT-11 | 635.9 | 2.41 | 633.49 | 4.45 | 631.45 | 7.30 | 628.60 | 8.55 | 627.35 |
| PT-24 | 636.4 | 4.56 | 631.84 | 5.19 | 631.21 | 6.54 | 629.86 | 8.31 | 628.09 |
| MW-29 | 637.31 | 5.76 | 631.55 | 6.79 | 630.52 | 8.80 | 628.51 | dry | dry |
| MW-28 | 637.21 | 4.56 | 632.65 | 5.59 | 631.62 | 6.85 | 630.36 | 8.30 | 628.91 |
| MW-27 | 639.32 | 4.95 | 634.37 | 6.58 | 632.74 | 7.61 | 631.71 | 8.43 | 630.89 |
| MW-53 | 639.41 | 5.87 | 633.54 | 7.65 | 631.76 | 9.70 | 629.71 | dry | dry |
| PT-17 | 640.14 | 4.54 | 635.60 | 7.44 | 632.70 | 9.58 | 630.56 | dry | dry |
| MW-30 | 640.32 | 5.02 | 635.30 | 8.60 | 631.72 | dry | dry | dry | dry |

Table 1
Seneca Army Depot Activity
Ash Landfill Treatibility Study
Groundwater Elevations - Monthly Measurements

| | Elevation at | August 30, 1999 | | September 27, 1999 | | October 29, 1999 | | November 28, 1999 | |
|---|---|---|---|---|---|---|---|---|---|
| Monitoring Well | Top of Riser (MSL) | Depth from Top of Riser (ft) | Elevation of Water Level (ft) | Depth from Top of Riser (ft) | Elevation of Water Level (ft) | Depth from Top of Riser (ft) | Elevation of Water Level (ft) | Depth from Top of Riser (ft) | Elevation of Water Level (ft) |
| MWT-1 | 637.24 | 9.05 | 628.19 | 7.92 | 629.32 | 6.26 | 630.98 | 5.53 | 631.71 |
| MWT-2 | 637.19 | 9.00 | 628.19 | 7.90 | 629.29 | 6.26 | 630.93 | 5.46 | 631.73 |
| MWT-3 | 637.31 | 9.14 | 628.17 | 7.92 | 629.39 | 6.37 | 630.94 | 5.59 | 631.72 |
| MWT-4 | 637.68 | 11.25 | 626.43 | 9.96 | 627.72 | 7.57 | 630.11 | 6.45 | 631.23 |
| MWT-5 | 637.72 | 11.36 | 626.36 | 10.00 | 627.72 | 7.66 | 630.06 | 6.53 | 631.19 |
| MWT-6 | 637.59 | 11.21 | 626.38 | 9.90 | 627.69 | 7.52 | 630.07 | 6.41 | 631.18 |
| MWT-7 | 638.34 | 12.70 | 625.64 | 10.64 | 627.70 | 8.44 | 629.90 | 7.13 | 631.21 |
| MWT-8 | 638.4 | dry | dry | 10.78 | 627.62 | 8.54 | 629.86 | 7.22 | 631.18 |
| MWT-9 | 638.08 | 12.60 | 625.48 | 10.58 | 627.50 | 8.25 | 629.83 | 6.95 | 631.13 |
| MWT-10 | 636.07 | 7.55 | 628.52 | 6.50 | 629.57 | 5.25 | 630.82 | 4.36 | 631.71 |
| MWT-11 | 635.9 | 8.95 | 626.95 | 7.14 | 628.76 | 5.52 | 630.38 | 4.15 | 631.75 |
| PT-24 | 636.4 | 8.20 | 628.20 | 8.04 | 628.36 | 6.10 | 630.30 | 5.04 | 631.36 |
| MW-29 | 637.31 | dry | dry | dry | dry | 8.00 | 629.31 | 6.79 | 630.52 |
| MW-28 | 637.21 | 9.05 | 628.16 | 7.92 | 629.29 | 6.34 | 630.87 | 5.5 | 631.71 |
| MW-27 | 639.32 | 8.70 | 630.62 | 7.14 | 632.18 | 6.60 | 632.72 | 5.21 | 634.11 |
| MW-53 | 639.41 | 10.00 | 629.41 | 9.88 | 629.53 | 8.71 | 630.70 | 7.61 | 631.80 |
| PT-17 | 640.14 | 11.00 | 629.14 | 9.10 | 631.04 | 8.05 | 632.09 | 5.14 | 635.00 |
| MW-30 | 640.32 | dry | dry | dry | dry | 9.57 | 630.75 | 7.27 | 633.05 |

Table 2
Seneca Army Depot Activity
Ash Landfill Treatibility Study
Groundwater Sampling - Round 1

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | |
| | | | MWT-1 | | MWT-10 | | MWT-11 | | MWT-2 | | MWT-3 | | MWT-4 | |
| | | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | |
| | | | TR2002 | | TR2001 | | TR2000 | | TR2008 | | TR2007 | | TR2004 | |
| | | | 8 | | 7 | | 8 | | 11.3 | | 8 | | 10 | |
| | | | 8 | | 7 | | 8 | | 11.3 | | 8 | | 10 | |
| | | NYSDEC | 4/26/1999 | | 4/26/1999 | | 4/26/1999 | | 4/28/1999 | | 4/27/1999 | | 4/26/1999 | |
| | | CLASS GA | SA | | SA | | SA | | SA | | SA | | SA | |
| | | STANDARD | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | |
| **Volatile Organic Compounds** | | | N | | N | | N | | N | | N | | N | |
| 1,1,1-Trichloroethane | UG/L | 5 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| 1,1,2,2-Tetrachloroethane | UG/L | 5 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| 1,1,2-Trichloroethane | UG/L | | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| 1,1-Dichloroethane | UG/L | 5 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| 1,1-Dichloroethene | UG/L | 5 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| 1,2,4-Trichlorobenzene | UG/L | 5 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| 1,2-Dibromo-3-chloropropane | UG/L | | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| 1,2-Dibromoethane | UG/L | | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| 1,2-Dichlorobenzene | UG/L | 4.7 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| 1,2-Dichloroethane | UG/L | 5 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| 1,2-Dichloropropane | UG/L | 5 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| 1,3-Dichlorobenzene | UG/L | 5 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| 1,4-Dichlorobenzene | UG/L | 4.7 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| Acetone | UG/L | | 20 | U | 5 | U | 5 | U | 6 | | 8 | U | 14 | U |
| Benzene | UG/L | 0.7 | 4 | U | 0.7 | J | 1 | U | 0.7 | J | 0.4 | J | 3 | U |
| Bromochloromethane | UG/L | | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| Bromodichloromethane | UG/L | | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| Bromoform | UG/L | | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| Carbon disulfide | UG/L | | 4 | U | 1 | U | 1 | U | 1 | | 2 | U | 3 | U |
| Carbon tetrachloride | UG/L | 5 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| Chlorobenzene | UG/L | 5 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| Chlorodibromomethane | UG/L | | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| Chloroethane | UG/L | 5 | 4 | UJ | 1 | UJ | 1 | UJ | 1 | U | 2 | UJ | 3 | UJ |
| Chloroform | UG/L | 7 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| Cis-1,2-Dichloroethene | UG/L | 5 | 73 | | 6 | | 1 | U | 27 | | 27 | | 49 | |
| Cis-1,3-Dichloropropene | UG/L | 5 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| Ethyl benzene | UG/L | 5 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| Methyl bromide | UG/L | | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| Methyl butyl ketone | UG/L | | 20 | U | 5 | U | 5 | U | 5 | U | 8 | U | 14 | U |
| Methyl chloride | UG/L | 5 | 4 | UJ | 1 | UJ | 1 | UJ | 1 | U | 2 | UJ | 3 | UJ |

Table 2
Seneca Army Depot Activity
Ash Landfill Treatibility Study
Groundwater Sampling - Round 1

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | |
| | | | MWT-1 | | MWT-10 | | MWT-11 | | MWT-2 | | MWT-3 | | MWT-4 | |
| | | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | |
| | | | TR2002 | | TR2001 | | TR2000 | | TR2008 | | TR2007 | | TR2004 | |
| | | | 8 | | 7 | | 8 | | 11.3 | | 8 | | 10 | |
| | | | 8 | | 7 | | 8 | | 11.3 | | 8 | | 10 | |
| | | NYSDEC | 4/26/1999 | | 4/26/1999 | | 4/26/1999 | | 4/28/1999 | | 4/27/1999 | | 4/26/1999 | |
| | | CLASS GA | SA | | SA | | SA | | SA | | SA | | SA | |
| | | STANDARD | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | |
| Methyl ethyl ketone | UG/L | 50 | 20 | U | 5 | U | 5 | U | 5 | U | 8 | U | 14 | U |
| Methyl isobutyl ketone | UG/L | | 20 | U | 5 | U | 5 | U | 5 | U | 8 | U | 14 | U |
| Methylene chloride | UG/L | 5 | 8 | U | 2 | U | 2 | U | 2 | U | 3 | U | 6 | U |
| Styrene | UG/L | | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| Tetrachloroethene | UG/L | 5 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| Toluene | UG/L | 5 | 4 | U | 1 | U | 1 | U | 0.7 | J | 2 | U | 3 | U |
| Total Xylenes | UG/L | 5 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| Trans-1,2-Dichloroethene | UG/L | 5 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| Trans-1,3-Dichloropropene | UG/L | 5 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| Trichloroethene | UG/L | 5 | 23 | | 1 | U | 1 | U | 1 | | 1 | J | 2 | J |
| Vinyl chloride | UG/L | 2 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| **Metals** | | | | | | | | | | | | | | |
| Calcium | UG/L | | 122000 | | 49900 | | 102000 | | 264000 | | 58000 | | 118000 | |
| Iron | UG/L | 300 | 403 | J | 13100 | J | 54.6 | J | 523000 | J | 3600 | J | 983 | J |
| Magnesium | UG/L | | 13800 | | 10600 | | 12800 | | 60800 | | 13000 | | 14300 | |
| Manganese | UG/L | 300 | 13.2 | J | 191 | | 78 | | 6260 | | 611 | | 37.1 | |
| Potassium | UG/L | | 1460 | J | 1520 | J | 5600 | | 15100 | | 1900 | J | 1860 | J |
| Methane | UG/L | | 1.2 | U | 4.5 | | 4.1 | | 20 | | 7.1 | | 1.2 | U |
| Ethane | UG/L | | 2.1 | U | 6.8 | | 2.1 | U | 8.3 | | 7.8 | | 2.1 | U |
| Ethene | UG/L | | 2.5 | U | 2.5 | U | 2.5 | U | 8.8 | | 9.3 | | 2.5 | U |
| Sulfate | MG/L | | 91.1 | | 51.7 | | 49.7 | | 82 | | 84.2 | | 106 | |
| Nitrate | MG/L | | 0.3 | | <0.2 | | 0.3 | | <0.2 | | <0.2 | | 0.3 | |
| Chloride | MG/L | | 15.2 | | 11.5 | | 11.5 | | 15 | | 15.6 | | 21.5 | |
| TDS | MG/L | | 438 | | 206 | | 366 | | 269 | | 252 | | 441 | |
| pH | | | 7.19 | | 7.54 | | 7.26 | | 7.83 | | 7.41 | | 7.16 | |
| Alkalinity | MG/L | | 266 | | 113 | | 280 | | 378 | | 107 | | 238 | |
| Phosphate | MG/L | | 0.01 | | 0.03 | | 0.01 | | 0.44 | | 0.04 | | 0.04 | |

Table 2
Seneca Army Depot Activity
Ash Landfill Treatibility Study
Groundwater Sampling - Round 1

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | |
| | | | MWT-5 | | MWT-6 | | MWT-6 | | MWT-7 | | MWT-8 | | MWT-9 | |
| | | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | |
| | | | TR2009 | | TR2011 | | TR2006 | | TR2003 | | TR2010 | | TR2005 | |
| | | | 11.1 | | 10.5 | | 10.5 | | 11.5 | | 11.58 | | 12.14 | |
| | | | 11.1 | | 10.5 | | 10.5 | | 11.5 | | 11.58 | | 12.14 | |
| | | NYSDEC | 4/28/1999 | | 4/28/1999 | | 4/28/1999 | | 4/27/1999 | | 4/28/1999 | | 4/27/1999 | |
| | | CLASS GA | SA | | DU | | SA | | SA | | SA | | SA | |
| | | STANDARD | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | |
| **Volatile Organic Compounds** | | | N | | N | | N | | N | | N | | N | |
| 1,1,1-Trichloroethane | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| 1,1,2,2-Tetrachloroethane | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| 1,1,2-Trichloroethane | UG/L | | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| 1,1-Dichloroethane | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| 1,1-Dichloroethene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| 1,2,4-Trichlorobenzene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| 1,2-Dibromo-3-chloropropane | UG/L | | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| 1,2-Dibromoethane | UG/L | | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| 1,2-Dichlorobenzene | UG/L | 4.7 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| 1,2-Dichloroethane | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| 1,2-Dichloropropane | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| 1,3-Dichlorobenzene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| 1,4-Dichlorobenzene | UG/L | 4.7 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Acetone | UG/L | | 7 | | 6 | | 5 | | 110 | U | 16 | | 11 | U |
| Benzene | UG/L | 0.7 | 0.9 | J | 0.7 | J | 0.7 | J | 22 | U | 1 | U | 2 | U |
| Bromochloromethane | UG/L | | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Bromodichloromethane | UG/L | | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Bromoform | UG/L | | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Carbon disulfide | UG/L | | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Carbon tetrachloride | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Chlorobenzene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Chlorodibromomethane | UG/L | | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Chloroethane | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | UJ | 1 | U | 2 | UJ |
| Chloroform | UG/L | 7 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Cis-1,2-Dichloroethene | UG/L | 5 | 0.7 | J | 3 | | 3 | | 20 | J | 1 | U | 32 | |
| Cis-1,3-Dichloropropene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Ethyl benzene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Methyl bromide | UG/L | | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Methyl butyl ketone | UG/L | | 5 | U | 5 | U | 5 | U | 110 | U | 5 | U | 11 | U |
| Methyl chloride | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | UJ | 1 | U | 2 | UJ |

Table 2
Seneca Army Depot Activity
Ash Landfill Treatibility Study
Groundwater Sampling - Round 1

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | |
| | | | MWT-5 | | MWT-6 | | MWT-6 | | MWT-7 | | MWT-8 | | MWT-9 | |
| | | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | |
| | | | TR2009 | | TR2011 | | TR2006 | | TR2003 | | TR2010 | | TR2005 | |
| | | | 11.1 | | 10.5 | | 10.5 | | 11.5 | | 11.58 | | 12.14 | |
| | | | 11.1 | | 10.5 | | 10.5 | | 11.5 | | 11.58 | | 12.14 | |
| | | NYSDEC | 4/28/1999 | | 4/28/1999 | | 4/28/1999 | | 4/27/1999 | | 4/28/1999 | | 4/27/1999 | |
| | | CLASS GA | SA | | DU | | SA | | SA | | SA | | SA | |
| | | STANDARD | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | |
| Methyl ethyl ketone | UG/L | 50 | 5 | U | 5 | U | 5 | U | 110 | U | 5 | U | 11 | U |
| Methyl isobutyl ketone | UG/L | | 5 | U | 5 | U | 5 | U | 110 | U | 5 | U | 11 | U |
| Methylene chloride | UG/L | 5 | 2 | U | 2 | U | 2 | U | 44 | U | 2 | U | 4 | U |
| Styrene | UG/L | | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Tetrachloroethene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Toluene | UG/L | 5 | 0.3 | J | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Total Xylenes | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Trans-1.2-Dichloroethene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Trans-1.3-Dichloropropene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Trichloroethene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 430 | | 1 | U | 43 | |
| Vinyl chloride | UG/L | 2 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| **Metals** | | | | | | | | | | | | | | |
| Calcium | UG/L | | 177000 | | 44000 | | 43800 | | 122000 | | 40200 | | 36200 | |
| Iron | UG/L | 300 | 548000 | J | 392 | J | 244 | J | 228 | J | 37300 | J | 1010 | J |
| Magnesium | UG/L | | 74400 | | 4970 | J | 4920 | J | 14300 | | 9830 | | 9520 | |
| Manganese | UG/L | 300 | 5010 | | 169 | | 170 | | 22.5 | | 416 | | 444 | |
| Potassium | UG/L | | 14200 | | 2080 | J | 1910 | J | 2030 | J | 6250 | | 1600 | J |
| Methane | UG/L | | 14 | | 9.4 | | 1.2 | U | 3.6 | | 13 | | 6.9 | |
| Ethane | UG/L | | 12 | | 13 | | 2.1 | U | 2.1 | U | 13 | | 14 | |
| Ethene | UG/L | | 8.7 | | 8.7 | | 2.5 | U | 2.5 | U | 8 | | 12 | |
| Sulfate | MG/L | | 107 | | 108 | | 113 | | 74.2 | | 61.6 | | 47.2 | |
| Nitrate | MG/L | | <0.2 | | <0.2 | | <0.2 | | 0.4 | | <0.2 | | <0.2 | |
| Chloride | MG/L | | 23.4 | | 24.6 | | 25.2 | | 8.7 | | 7.6 | | 8.3 | |
| TDS | MG/L | | 219 | | 219 | | 219 | | 433 | | 145 | | 174 | |
| pH | | | 9.14 | | 8.81 | | 8.72 | | 7.17 | | 9.74 | | 7.84 | |
| Alkalinity | MG/L | | 378 | | 23 | | 22 | | 304 | | 378 | | 97 | |
| Phosphate | MG/L | | 0.06 | | 0.05 | | 0.05 | | 0.02 | | 0.26 | | 0.03 | |

Table 3
Seneca Army Depot Activity
Ash Landfill Treatibility Study
Groundwater Analysis - Round 2

| | | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | MWT-1 | | MWT-10 | | MWT-11 | | MWT-2 | | MWT-3 | | MWT-4 | |
| | | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | |
| | | | TR2023 | | TR2020 | | TR2029 | | TR2021 | | TR2022 | | TR2025 | |
| | | | 8.1 | | 7 | | 9.5 | | 8 | | 8 | | 10 | |
| | | | 8.1 | | 7 | | 9.5 | | 8 | | 8 | | 10 | |
| | | NYSDEC | 6/29/1999 | | 6/29/1999 | | 6/29/1999 | | 6/29/1999 | | 6/29/1999 | | 6/29/1999 | |
| | | CLASS GA | SA | | SA | | SA | | SA | | SA | | SA | |
| | | STANDARD | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | |
| **Volatile Organic Compounds** | | | N | | N | | N | | N | | N | | N | |
| 1,1,1-Trichloroethane | UG/L | 5 | 2 | UJ | 1 | UJ | 1 | UJ | 1 | UJ | 1 | UJ | 4 | UJ |
| 1,1,2,2-Tetrachloroethane | UG/L | 5 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| 1,1,2-Trichloroethane | UG/L | | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| 1,1-Dichloroethane | UG/L | 5 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| 1,1-Dichloroethene | UG/L | 5 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| 1,2,4-Trichlorobenzene | UG/L | 5 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| 1,2-Dibromo-3-chloropropane | UG/L | | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| 1,2-Dibromoethane | UG/L | | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| 1,2-Dichlorobenzene | UG/L | 4.7 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| 1,2-Dichloroethane | UG/L | 5 | 2 | UJ | 1 | UJ | 1 | UJ | 1 | UJ | 1 | UJ | 4 | UJ |
| 1,2-Dichloropropane | UG/L | 5 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| 1,3-Dichlorobenzene | UG/L | 5 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| 1,4-Dichlorobenzene | UG/L | 4.7 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Acetone | UG/L | | 4 | J | 3 | J | 5 | U | 5 | | 3 | J | 14 | J |
| Benzene | UG/L | 0.7 | 2 | U | 0.9 | J | 1 | U | 0.6 | J | 1 | U | 4 | U |
| Bromochloromethane | UG/L | | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Bromodichloromethane | UG/L | | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Bromoform | UG/L | | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Carbon disulfide | UG/L | | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Carbon tetrachloride | UG/L | 5 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Chlorobenzene | UG/L | 5 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Chlorodibromomethane | UG/L | | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Chloroethane | UG/L | 5 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Chloroform | UG/L | 7 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Cis-1,2-Dichloroethene | UG/L | 5 | 32 | | 0.7 | J | 1 | U | 6 | | 10 | | 82 | |
| Cis-1,3-Dichloropropene | UG/L | 5 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Ethyl benzene | UG/L | 5 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Methyl bromide | UG/L | | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Methyl butyl ketone | UG/L | | 8 | UJ | 5 | UJ | 5 | UJ | 5 | UJ | 5 | UJ | 21 | UJ |
| Methyl chloride | UG/L | 5 | 2 | UJ | 1 | UJ | 1 | UJ | 1 | UJ | 1 | UJ | 4 | UJ |

Table 3
Seneca Army Depot Activity
Ash Landfill Treatibility Study
Groundwater Analysis - Round 2

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | |
| | | | MWT-1 | | MWT-10 | | MWT-11 | | MWT-2 | | MWT-3 | | MWT-4 | |
| | | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | |
| | | | TR2023 | | TR2020 | | TR2029 | | TR2021 | | TR2022 | | TR2025 | |
| | | | 8.1 | | 7 | | 9.5 | | 8 | | 8 | | 10 | |
| | | | 8.1 | | 7 | | 9.5 | | 8 | | 8 | | 10 | |
| | | NYSDEC | 6/29/1999 | | 6/29/1999 | | 6/29/1999 | | 6/29/1999 | | 6/29/1999 | | 6/29/1999 | |
| | | CLASS GA | SA | | SA | | SA | | SA | | SA | | SA | |
| | | STANDARD | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | |
| Methyl ethyl ketone | UG/L | 50 | 8 | U | 14 | | 5 | U | 7 | | 5 | | 21 | U |
| Methyl isobutyl ketone | UG/L | | 8 | U | 5 | U | 5 | U | 5 | U | 5 | U | 21 | U |
| Methylene chloride | UG/L | 5 | 3 | U | 2 | U | 2 | U | 2 | U | 2 | U | 8 | U |
| Styrene | UG/L | | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Tetrachloroethene | UG/L | 5 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Toluene | UG/L | 5 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Total Xylenes | UG/L | 5 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Trans-1,2-Dichloroethene | UG/L | 5 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Trans-1,3-Dichloropropene | UG/L | 5 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Trichloroethene | UG/L | 5 | 8 | | 1 | U | 1 | U | 1 | U | 0.8 | J | 2 | J |
| Vinyl chloride | UG/L | 2 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| **Metals** | | | | | | | | | | | | | | |
| Calcium | UG/L | | 120000 | | 22700 | | 107000 | | 16300 | | 47700 | | 158000 | |
| Iron | UG/L | 300 | 133 | | 1620 | | 553 | | 14100 | | 3190 | | 21 | J |
| Magnesium | UG/L | | 13000 | | 6500 | | 16500 | | 6080 | | 6820 | | 18300 | |
| Manganese | UG/L | 300 | 31 | | 44.6 | | 115 | | 165 | | 467 | | 5.2 | J |
| Potassium | UG/L | | 1590 | J | 1290 | J | 12300 | | 1580 | J | 2750 | J | 1880 | J |
| Methane | UG/L | | 14 | | 63 | | 5.4 | | 310 | | 180 | | 1.2 | U |
| Ethane | UG/L | | 2.1 | U | 10 | | 2.1 | U | 12 | | 9.5 | | 2.1 | U |
| Ethene | UG/L | | 2.5 | U | 2.5 | U | 2.5 | U | 10 | | 2.5 | U | 2.5 | U |
| Sulfate | MG/L | | 60.1 | | 0.7 | | 60.5 | | 5.8 | | 31.9 | | 163 | |
| Nitrate | MG/L | | <0.2 | | <0.2 | | <0.2 | | <0.2 | | <0.2 | | 0.3 | |
| Chloride | MG/L | | 12.7 | | 8 | | 13.8 | | 11.1 | | 12.8 | | 31.7 | |
| TDS | MG/L | | 392 | J | 113 | J | 405 | J | 85 | J | 223 | J | 577 | J |
| pH | | | 7.19 | | 8.43 | | 7.36 | | 9.1 | | 7.68 | | 7.14 | |
| Alkalinity | MG/L | | 264 | | 65 | | 280 | | 48 | | 140 | | 240 | |
| Phosphate | MG/L | | <0.01 | | 0.02 | | 0.03 | | 0.17 | | 0.11 | | <0.01 | |

p:\pit\projects\seneca\irontrenc\gwdata\data.xls

Table 3
Seneca Army Depot Activity
Ash Landfill Treatibility Study
Groundwater Analysis - Round 2

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | |
| | | | MWT-5 | | MWT-6 | | MWT-7 | | MWT-8 | | MWT-9 | |
| | | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | |
| | | | TR2024 | | TR2028 | | TR2026 | | TR2030 | | TR2027 | |
| | | | 10 | | 10 | | 10 | | 10 | | 12 | |
| | | | 10 | | 10 | | 10 | | 10 | | 12 | |
| | | NYSDEC | 6/29/1999 | | 6/29/1999 | | 6/29/1999 | | 6/29/1999 | | 6/29/1999 | |
| | | CLASS GA | SA | | SA | | SA | | SA | | SA | |
| | | STANDARD | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | |
| **Volatile Organic Compounds** | | | N | | N | | N | | N | | N | |
| 1,1,1-Trichloroethane | UG/L | 5 | 1 | UJ | 1 | UJ | 31 | UJ | 2 | UJ | 8 | UJ |
| 1,1,2,2-Tetrachloroethane | UG/L | 5 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| 1,1,2-Trichloroethane | UG/L | | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| 1,1-Dichloroethane | UG/L | 5 | 0.7 | J | 1 | U | 31 | U | 2 | U | 8 | U |
| 1,1-Dichloroethene | UG/L | 5 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| 1,2,4-Trichlorobenzene | UG/L | 5 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| 1,2-Dibromo-3-chloropropane | UG/L | | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| 1,2-Dibromoethane | UG/L | | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| 1,2-Dichlorobenzene | UG/L | 4.7 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| 1,2-Dichloroethane | UG/L | 5 | 1 | UJ | 1 | UJ | 31 | UJ | 2 | UJ | 8 | UJ |
| 1,2-Dichloropropane | UG/L | 5 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| 1,3-Dichlorobenzene | UG/L | 5 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| 1,4-Dichlorobenzene | UG/L | 4.7 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Acetone | UG/L | | 3 | J | 3 | J | 140 | J | 4 | J | 24 | J |
| Benzene | UG/L | 0.7 | 0.8 | J | 0.7 | J | 31 | U | 2 | U | 8 | U |
| Bromochloromethane | UG/L | | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Bromodichloromethane | UG/L | | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Bromoform | UG/L | | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Carbon disulfide | UG/L | | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Carbon tetrachloride | UG/L | 5 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Chlorobenzene | UG/L | 5 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Chlorodibromomethane | UG/L | | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Chloroethane | UG/L | 5 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Chloroform | UG/L | 7 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Cis-1,2-Dichloroethene | UG/L | 5 | 20 | | 17 | | 32 | | 42 | | 150 | |
| Cis-1,3-Dichloropropene | UG/L | 5 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Ethyl benzene | UG/L | 5 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Methyl bromide | UG/L | | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Methyl butyl ketone | UG/L | | 5 | UJ | 5 | UJ | 160 | UJ | 8 | UJ | 42 | UJ |
| Methyl chloride | UG/L | 5 | 1 | UJ | 1 | UJ | 31 | UJ | 2 | UJ | 8 | UJ |

Table 3
Seneca Army Depot Activity
Ash Landfill Treatibility Study
Groundwater Analysis - Round 2

| | | NYSDEC CLASS GA STANDARD | ASH LANDFILL MWT-5 GROUND WATER TR2024 10 10 6/29/1999 SA ASH TRENCH | | ASH LANDFILL MWT-6 GROUND WATER TR2028 10 10 6/29/1999 SA ASH TRENCH | | ASH LANDFILL MWT-7 GROUND WATER TR2026 10 10 6/29/1999 SA ASH TRENCH | | ASH LANDFILL MWT-8 GROUND WATER TR2030 10 10 6/29/1999 SA ASH TRENCH | | ASH LANDFILL MWT-9 GROUND WATER TR2027 12 12 6/29/1999 SA ASH TRENCH | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Methyl ethyl ketone | UG/L | 50 | 5 | U | 5 | U | 160 | U | 8 | U | 42 | U |
| Methyl isobutyl ketone | UG/L | | 5 | U | 5 | U | 160 | U | 8 | U | 42 | U |
| Methylene chloride | UG/L | 5 | 2 | U | 2 | U | 63 | U | 3 | U | 17 | U |
| Styrene | UG/L | | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Tetrachloroethene | UG/L | 5 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Toluene | UG/L | 5 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Total Xylenes | UG/L | 5 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Trans-1,2-Dichloroethene | UG/L | 5 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Trans-1,3-Dichloropropene | UG/L | 5 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Trichloroethene | UG/L | 5 | 1 | U | 1 | U | 530 | J | 2 | U | 52 | |
| Vinyl chloride | UG/L | 2 | 1 | | 0.7 | J | 31 | U | 1 | J | 8 | U |
| | | | | | | | | | | | | |
| **Metals** | | | | | | | | | | | | |
| Calcium | UG/L | | 30500 | | 39700 | | 153000 | | 23900 | | 87200 | |
| Iron | UG/L | 300 | 207 | | 145 | | 58.2 | J | 1090 | | 7800 | |
| Magnesium | UG/L | | 15200 | | 6270 | | 17700 | | 16300 | | 17000 | |
| Manganese | UG/L | 300 | 49.8 | | 240 | | 17.7 | | 97.9 | | 1280 | |
| Potassium | UG/L | | 1410 | J | 1780 | J | 1820 | J | 1430 | J | 1870 | J |
| | | | | | | | | | | | | |
| Methane | UG/L | | 41 | | 1.2 | U | 5.8 | | 6.2 | | 18 | |
| Ethane | UG/L | | 13 | | 2.1 | U | 11 | | 18 | | 13 | |
| Ethene | UG/L | | 16 | | 2.5 | U | 18 | | 20 | | 16 | |
| Sulfate | MG/L | | 95.1 | | 86.2 | | 124 | | 88.6 | | 103 | |
| Nitrate | MG/L | | <0.2 | | <0.2 | | 0.6 | | <0.2 | | <0.2 | |
| Chloride | MG/L | | 31.3 | | 29.9 | | 12.5 | | 14.6 | | 13.9 | |
| TDS | MG/L | | 233 | J | 201 | J | 531 | J | 194 | J | 351 | J |
| pH | | | 9.5 | | 8.6 | | 7.06 | | 9.22 | | 7.34 | |
| Alkalinity | MG/L | | 13 | | 25 | | 288 | | 46 | | 184 | |
| Phosphate | MG/L | | 0.03 | | 0.03 | | <.01 | | 0.02 | | 0.02 | |

Table 4
Seneca Army Depot Activity
Ash Landfill Treatibility Study
Groundwater Analysis - Round 3

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | |
| | | | MWT-1 | | MWT-11 | | MWT-10 | | MWT-2 | | MWT-3 | | MWT-4 | |
| | | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | |
| | | | TR2040 | | TR2050 | | TR2049 | | TR2041 | | TR2042 | | TR2051 | |
| | | | 9 | | 0 | | 8 | | 8.5 | | 9.1 | | 0 | |
| | | | 9 | | 0 | | 8 | | 8.5 | | 9.1 | | 0 | |
| | | NYSDEC | 9/28/1999 | | 9/29/1999 | | 9/28/1999 | | 9/28/1999 | | 9/29/1999 | | 9/29/1999 | |
| | | CLASS GA | SA | | SA | | SA | | SA | | SA | | DU | |
| | | STANDARD | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | |
| **Volatile Organic Compounds** | | | N | | N | | N | | N | | N | | N | |
| 1,1,1-Trichloroethane | UG/L | 5 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| 1,1,2,2-Tetrachloroethane | UG/L | 5 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| 1,1,2-Trichloroethane | UG/L | | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| 1,1-Dichloroethane | UG/L | 5 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| 1,1-Dichloroethene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| 1,2,4-Trichlorobenzene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| 1,2-Dibromo-3-chloropropane | UG/L | | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| 1,2-Dibromoethane | UG/L | | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| 1,2-Dichlorobenzene | UG/L | 4.7 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| 1,2-Dichloroethane | UG/L | 5 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| 1,2-Dichloropropane | UG/L | 5 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| 1,3-Dichlorobenzene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| 1,4-Dichlorobenzene | UG/L | 4.7 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| Acetone | UG/L | | 5 | UJ | 5 | UJ | 15 | UJ | 6 | UJ | 5 | UJ | 14 | UJ |
| Benzene | UG/L | 0.7 | 1 | U | 1 | U | 1 | | 0.8 | J | 1 | U | 3 | U |
| Bromochloromethane | UG/L | | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| Bromodichloromethane | UG/L | | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| Bromoform | UG/L | | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| Carbon disulfide | UG/L | | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| Carbon tetrachloride | UG/L | 5 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| Chlorobenzene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| Chlorodibromomethane | UG/L | | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| Chloroethane | UG/L | 5 | 1 | UJ | 1 | UJ | 1 | UJ | 1 | UJ | 1 | UJ | 3 | UJ |
| Chloroform | UG/L | 7 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| Cis-1,2-Dichloroethene | UG/L | 5 | 6 | | 1 | U | 1 | U | 0.6 | J | 2 | | 39 | |
| Cis-1,3-Dichloropropene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| Ethyl benzene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| Methyl bromide | UG/L | | 1 | UJ | 1 | UJ | 1 | UJ | 1 | UJ | 1 | UJ | 3 | U |
| Methyl butyl ketone | UG/L | | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U | 14 | U |
| Methyl chloride | UG/L | 5 | 1 | U | 1 | UJ | 1 | UJ | 1 | U | 1 | U | 3 | UJ |

Table 4
Seneca Army Depot Activity
Ash Landfill Treatibility Study
Groundwater Analysis - Round 3

| | | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | MWT-1 | | MWT-11 | | MWT-10 | | MWT-2 | | MWT-3 | | MWT-4 | |
| | | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | |
| | | | TR2040 | | TR2050 | | TR2049 | | TR2041 | | TR2042 | | TR2051 | |
| | | | 9 | | 0 | | 8 | | 8.5 | | 9.1 | | 0 | |
| | | | 9 | | 0 | | 8 | | 8.5 | | 9.1 | | 0 | |
| | | NYSDEC | 9/28/1999 | | 9/29/1999 | | 9/28/1999 | | 9/28/1999 | | 9/29/1999 | | 9/29/1999 | |
| | | CLASS GA | SA | | SA | | SA | | SA | | SA | | DU | |
| | | STANDARD | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | |
| Methyl ethyl ketone | UG/L | 50 | 5 | UJ | 5 | UJ | 6 | UJ | 5 | UJ | 5 | UJ | 14 | UJ |
| Methyl isobutyl ketone | UG/L | | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U | 14 | U |
| Methylene chloride | UG/L | 5 | 2 | U | 2 | U | 2 | U | 2 | U | 2 | U | 6 | U |
| Styrene | UG/L | | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| Tetrachloroethene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| Toluene | UG/L | 5 | 1 | U | 1 | U | 0.3 | J | 0.2 | J | 1 | U | 3 | U |
| Total Xylenes | UG/L | 5 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| Trans-1,2-Dichloroethene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| Trans-1,3-Dichloropropene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| Trichloroethene | UG/L | 5 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| Vinyl chloride | UG/L | 2 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| **Metals** | | | | | | | | | | | | | | |
| Calcium | UG/L | | 117000 | J | 149000 | J | 7610 | J | 20000 | J | 146000 | J | 90100 | J |
| Iron | UG/L | 300 | 906 | J | 4700 | J | 1170 | J | 1420 | | 68500 | | 117 | |
| Magnesium | UG/L | | 12500 | | 24900 | | 1490 | J | 9260 | | 25500 | | 9610 | |
| Manganese | UG/L | 300 | 21.4 | | 312 | | 17.7 | | 54.6 | | 1780 | | 21.8 | |
| Potassium | UG/L | | 1960 | J | 17100 | | 1200 | J | 3180 | J | 19900 | | 1720 | |
| Methane | UG/L | | 110 | | 2.1 | | 2300 | | 200 | | 72 | | 110 | |
| Ethane | UG/L | | 2.1 | U | 2.1 | U | 2.1 | | 2.1 | U | 2.1 | U | 2.1 | U |
| Ethene | UG/L | | 2.5 | U | 2.5 | U | 2.5 | U | 2.5 | U | 2.5 | U | 2.5 | U |
| Sulfate | MG/L | | 46.3 | | 98 | | 0.4 | | 58.7 | | 78.4 | | 61.1 | |
| Nitrate | MG/L | | 0.2 | | <0.2 | | <0.2 | | 0.3 | | <0.2 | | 0.2 | |
| Chloride | MG/L | | 10.9 | | 14.5 | | 8.4 | | 11.2 | | 11.9 | | 26 | |
| TDS | MG/L | | 332 | | 547 | | 38 | | 121 | | 321 | | 275 | |
| pH | | | 7.27 | | 7.03 | | 9.7 | | 9.15 | | 7.5 | | 7.42 | |
| Alkalinity | MG/L | | 254 | | 426 | | 26 | | 34 | | 168 | | 168 | |
| Phosphate | MG/L | | 0.06 | | 13 | | 0.05 | | 0.09 | | 0.05 | | 0.01 | |
| Ferrous Iron | MG/L | | | | 2.55 | | | | | | | | 0.1 | |

Table 4
Seneca Army Depot Activity
Ash Landfill Treatibility Study
Groundwater Analysis - Round 3

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | |
| | | | MWT-4 | | MWT-4 | | MWT-4 | | MWT-5 | | MWT-6 | | MWT-7 | |
| | | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | |
| | | | TR2043 | | TR2043MS | | TR2043MSD | | TR2044 | | TR2045 | | TR2046 | |
| | | | 11 | | 11 | | 11 | | 11 | | 11.7 | | 12.6 | |
| | | | 11 | | 11 | | 11 | | 11 | | 11.7 | | 12.6 | |
| | | NYSDEC | 9/29/1999 | | 9/29/1999 | | 9/29/1999 | | 9/28/1999 | | 9/29/1999 | | 9/28/1999 | |
| | | CLASS GA | SA | | SA | | SA | | SA | | SA | | SA | |
| | | STANDARD | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | |
| **Volatile Organic Compounds** | | | N | | N | | N | | N | | N | | N | |
| 1,1,1-Trichloroethane | UG/L | 5 | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| 1,1,2,2-Tetrachloroethane | UG/L | 5 | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| 1,1,2-Trichloroethane | UG/L | | 3 | U | 5 | | 4 | | 1 | U | 1 | U | 40 | U |
| 1,1-Dichloroethane | UG/L | 5 | 3 | U | 1 | U | 1 | U | 0.5 | J | 0.4 | J | 40 | U |
| 1,1-Dichloroethene | UG/L | 5 | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| 1,2,4-Trichlorobenzene | UG/L | 5 | 3 | U | 5 | | 5 | | 1 | U | 1 | U | 40 | U |
| 1,2-Dibromo-3-chloropropane | UG/L | | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| 1,2-Dibromoethane | UG/L | | 3 | U | 5 | | 5 | | 1 | U | 1 | U | 40 | U |
| 1,2-Dichlorobenzene | UG/L | 4.7 | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| 1,2-Dichloroethane | UG/L | 5 | 3 | U | 5 | | 5 | | 1 | U | 1 | U | 40 | U |
| 1,2-Dichloropropane | UG/L | 5 | 3 | U | 5 | | 5 | | 1 | U | 1 | U | 40 | U |
| 1,3-Dichlorobenzene | UG/L | 5 | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| 1,4-Dichlorobenzene | UG/L | 4.7 | 3 | U | 4 | | 4 | | 1 | U | 1 | U | 40 | U |
| Acetone | UG/L | | 14 | R | 2 | J | 5 | U | 6 | UJ | 5 | UJ | 200 | R |
| Benzene | UG/L | 0.7 | 3 | U | 5 | | 5 | | 0.6 | J | 0.4 | J | 40 | U |
| Bromochloromethane | UG/L | | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| Bromodichloromethane | UG/L | | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| Bromoform | UG/L | | 3 | U | 4 | | 4 | | 1 | U | 1 | U | 40 | U |
| Carbon disulfide | UG/L | | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| Carbon tetrachloride | UG/L | 5 | 3 | U | 4 | | 4 | | 1 | U | 1 | U | 40 | U |
| Chlorobenzene | UG/L | 5 | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| Chlorodibromomethane | UG/L | | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| Chloroethane | UG/L | 5 | 3 | UJ | 1 | U | 1 | U | 1 | UJ | 1 | UJ | 40 | UJ |
| Chloroform | UG/L | 7 | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| Cis-1,2-Dichloroethene | UG/L | 5 | 40 | | 14 | | 14 | | 5 | | 11 | | 25 | J |
| Cis-1,3-Dichloropropene | UG/L | 5 | 3 | U | 5 | | 4 | | 1 | U | 1 | U | 40 | U |
| Ethyl benzene | UG/L | 5 | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| Methyl bromide | UG/L | | 3 | UJ | 1 | U | 1 | U | 1 | UJ | 1 | UJ | 40 | UJ |
| Methyl butyl ketone | UG/L | | 14 | U | 5 | U | 5 | U | 5 | U | 5 | U | 200 | U |
| Methyl chloride | UG/L | 5 | 3 | UJ | 1 | U | 1 | U | 1 | U | 1 | UJ | 40 | UJ |

Table 4
Seneca Army Depot Activity
Ash Landfill Treatibility Study
Groundwater Analysis - Round 3

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | |
| | | | MWT-4 | | MWT-4 | | MWT-4 | | MWT-5 | | MWT-6 | | MWT-7 | |
| | | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | |
| | | | TR2043 | | TR2043MS | | TR2043MSD | | TR2044 | | TR2045 | | TR2046 | |
| | | | 11 | | 11 | | 11 | | 11 | | 11.7 | | 12.6 | |
| | | | 11 | | 11 | | 11 | | 11 | | 11.7 | | 12.6 | |
| | | NYSDEC | 9/29/1999 | | 9/29/1999 | | 9/29/1999 | | 9/28/1999 | | 9/29/1999 | | 9/28/1999 | |
| | | CLASS GA | SA | | SA | | SA | | SA | | SA | | SA | |
| | | STANDARD | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | |
| Methyl ethyl ketone | UG/L | 50 | 14 | UJ | 5 | U | 5 | U | 5 | UJ | 5 | UJ | 200 | UJ |
| Methyl isobutyl ketone | UG/L | | 14 | U | 5 | U | 5 | U | 5 | U | 5 | U | 200 | U |
| Methylene chloride | UG/L | 5 | 6 | U | 2 | U | 2 | U | 2 | U | 2 | U | 80 | U |
| Styrene | UG/L | | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| Tetrachloroethene | UG/L | 5 | 3 | U | 5 | | 5 | | 1 | U | 1 | U | 40 | U |
| Toluene | UG/L | 5 | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| Total Xylenes | UG/L | 5 | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| Trans-1,2-Dichloroethene | UG/L | 5 | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| Trans-1,3-Dichloropropene | UG/L | 5 | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| Trichloroethene | UG/L | 5 | 3 | U | 5 | | 5 | | 1 | U | 1 | U | 480 | |
| Vinyl chloride | UG/L | 2 | 3 | U | 4 | | 4 | | 1 | U | 1 | U | 40 | U |
| **Metals** | | | | | | | | | | | | | | |
| Calcium | UG/L | | 90100 | J | | | | | 11900 | J | 37100 | J | 158000 | J |
| Iron | UG/L | 300 | 92.6 | J | | | | | 565 | | 1150 | J | 109 | J |
| Magnesium | UG/L | | 9810 | | | | | | 6090 | | 4990 | J | 17800 | |
| Manganese | UG/L | 300 | 19.4 | | | | | | 32.2 | | 91.6 | | 28.2 | |
| Potassium | UG/L | | 1750 | J | | | | | 1760 | J | 2480 | J | 2180 | J |
| Methane | UG/L | | 140 | | | | | | 750 | | 63 | | 1.2 | |
| Ethane | UG/L | | 2.1 | U | | | | | 2.3 | | 2.1 | U | 2.1 | U |
| Ethene | UG/L | | 2.5 | U | | | | | 4.2 | | 2.5 | U | 2.5 | U |
| Sulfate | MG/L | | 54.2 | | | | | | 25.9 | | 46.5 | | 111 | |
| Nitrate | MG/L | | 0.2 | | | | | | <0.2 | | <0.2 | | 0.4 | |
| Chloride | MG/L | | 25.3 | | | | | | 18.1 | | 19.2 | | 14.1 | |
| TDS | MG/L | | 268 | | | | | | 84 | | 149 | | 536 | |
| pH | | | 7.5 | | | | | | 9.56 | | 7.81 | | 7.18 | |
| Alkalinity | MG/L | | 136 | | | | | | 34 | | 69 | | 336 | |
| Phosphate | MG/L | | 0.01 | | | | | | 0.03 | | 0.05 | | <.01 | |
| Ferrous Iron | MG/L | | | | | | | | | | 0.13 | | | |

p:\pit\projects\seneca\irontrenc\gwdata\data.xls

Table 4
Seneca Army Depot Activity
Ash Landfill Treatibility Study
Groundwater Analysis - Round 3

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | ASH LANDFILL | | ASH LANDFILL | |
| | | | MWT-8 | | MWT-9 | |
| | | | GROUND WATER | | GROUND WATER | |
| | | | TR2047 | | TR2048 | |
| | | | 11.8 | | 13.5 | |
| | | | 11.8 | | 13.5 | |
| | | NYSDEC | 9/28/1999 | | 9/29/1999 | |
| | | CLASS GA | SA | | SA | |
| | | STANDARD | ASH TRENCH | | ASH TRENCH | |
| **Volatile Organic Compounds** | | | N | | N | |
| 1,1,1-Trichloroethane | UG/L | 5 | 1 | U | 4 | U |
| 1,1,2,2-Tetrachloroethane | UG/L | 5 | 1 | U | 4 | U |
| 1,1,2-Trichloroethane | UG/L | | 1 | U | 4 | U |
| 1,1-Dichloroethane | UG/L | 5 | 1 | U | 4 | U |
| 1,1-Dichloroethene | UG/L | 5 | 1 | U | 4 | U |
| 1,2,4-Trichlorobenzene | UG/L | 5 | 1 | U | 4 | U |
| 1,2-Dibromo-3-chloropropane | UG/L | | 1 | U | 4 | U |
| 1,2-Dibromoethane | UG/L | | 1 | U | 4 | U |
| 1,2-Dichlorobenzene | UG/L | 4.7 | 1 | U | 4 | U |
| 1,2-Dichloroethane | UG/L | 5 | 1 | U | 4 | U |
| 1,2-Dichloropropane | UG/L | 5 | 1 | U | 4 | U |
| 1,3-Dichlorobenzene | UG/L | 5 | 1 | U | 4 | U |
| 1,4-Dichlorobenzene | UG/L | 4.7 | 1 | U | 4 | U |
| Acetone | UG/L | | 5 | UJ | 20 | R |
| Benzene | UG/L | 0.7 | 0.3 | J | 4 | U |
| Bromochloromethane | UG/L | | 1 | U | 4 | U |
| Bromodichloromethane | UG/L | | 1 | U | 4 | U |
| Bromoform | UG/L | | 1 | U | 4 | U |
| Carbon disulfide | UG/L | | 1 | U | 4 | U |
| Carbon tetrachloride | UG/L | 5 | 1 | U | 4 | U |
| Chlorobenzene | UG/L | 5 | 1 | U | 4 | U |
| Chlorodibromomethane | UG/L | | 1 | U | 4 | U |
| Chloroethane | UG/L | 5 | 1 | UJ | 4 | UJ |
| Chloroform | UG/L | 7 | 1 | U | 4 | U |
| Cis-1,2-Dichloroethene | UG/L | 5 | 7 | | 38 | |
| Cis-1,3-Dichloropropene | UG/L | 5 | 1 | U | 4 | U |
| Ethyl benzene | UG/L | 5 | 1 | U | 4 | U |
| Methyl bromide | UG/L | | 1 | UJ | 4 | UJ |
| Methyl butyl ketone | UG/L | | 5 | U | 20 | U |
| Methyl chloride | UG/L | 5 | 1 | U | 4 | UJ |

p:\pit\projects\seneca\irontrenc\gwdata\data.xls

Table 4
Seneca Army Depot Activity
Ash Landfill Treatibility Study
Groundwater Analysis - Round 3

| | | NYSDEC CLASS GA STANDARD | ASH LANDFILL MWT-8 GROUND WATER TR2047 11.8 11.8 9/28/1999 SA ASH TRENCH | | ASH LANDFILL MWT-9 GROUND WATER TR2048 13.5 13.5 9/29/1999 SA ASH TRENCH | |
|---|---|---|---|---|---|---|
| Methyl ethyl ketone | UG/L | 50 | 9 | UJ | 20 | UJ |
| Methyl isobutyl ketone | UG/L | | 5 | U | 20 | U |
| Methylene chloride | UG/L | 5 | 2 | U | 8 | U |
| Styrene | UG/L | | 1 | U | 4 | U |
| Tetrachloroethene | UG/L | 5 | 1 | U | 4 | U |
| Toluene | UG/L | 5 | 1 | U | 4 | U |
| Total Xylenes | UG/L | 5 | 1 | U | 4 | U |
| Trans-1,2-Dichloroethene | UG/L | 5 | 1 | U | 4 | U |
| Trans-1,3-Dichloropropene | UG/L | 5 | 1 | U | 4 | U |
| Trichloroethene | UG/L | 5 | 1 | U | 56 | |
| Vinyl chloride | UG/L | 2 | 1 | U | 4 | U |
| | | | | | | |
| **Metals** | | | | | | |
| Calcium | UG/L | | 13500 | J | 46700 | J |
| Iron | UG/L | 300 | 6590 | | 889 | J |
| Magnesium | UG/L | | 12600 | | 11500 | |
| Manganese | UG/L | 300 | 120 | | 538 | |
| Potassium | UG/L | | 2020 | J | 2870 | J |
| | | | | | | |
| Methane | UG/L | | 74 | | 120 | |
| Ethane | UG/L | | 3.1 | | 7.4 | |
| Ethene | UG/L | | 8.8 | | 15 | |
| Sulfate | MG/L | | 48.5 | | 44.6 | |
| Nitrate | MG/L | | <0.2 | | <0.2 | |
| Chloride | MG/L | | 10.9 | | 12.2 | |
| TDS | MG/L | | 120 | | 194 | |
| pH | | | 9.4 | | 7.68 | |
| Alkalinity | MG/L | | 50 | | 132 | |
| Phosphate | MG/L | | 0.04 | | 0.03 | |
| Ferrous Iron | MG/L | | | | 0.62 | |

**PARSONS ENGINEERING SCIENCE, INC.**

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

File

Ash LF Treatability Study.

January 5, 2000

Mr. Stephen Absolom
BRAC Environmental Coordinator
ATTN: SIOSE-BEC
Building 123
Seneca Army Depot Activity
Romulus, New York 14541-5001

**SUBJECT: Ash Landfill Reactive Wall Treatability Study**
**Quarterly Groundwater Sampling Results**
**Seneca Army Depot Activity, Romulus, New York**

Dear Mr. Absolom:

In accordance with Paragraph 24.2 of the Federal Facilities Agreement for this project, Parsons Engineering Science (Parsons) is pleased to submit the results of the initial three rounds of groundwater monitoring, which have been conducted as part of the Ash Landfill Reactive Wall Treatability Study. The treatability study will include four quarters of groundwater monitoring data and monthly water level measurements for one year. The first quarter of groundwater monitoring for the Ash Landfill Treatability Study was conducted between April 26 through 28, 1999; the second quarter was conducted on June 29, 1999; and the third quarter was conducted between September 28 and 29, 1999. This data has been validated.

In addition, water level measurements were performed monthly at 18 monitoring wells at the Ash Landfill site. **Figure 1** shows the locations of the monitoring wells. These monitoring wells include the 11 monitoring wells associated with the reactive iron wall and six additional monitoring wells located upgradient of the wall and one monitoring well located just downgradient of the wall. The groundwater elevation measurements are summarized in **Table 1**.

Groundwater samples were collected from 11 monitoring wells. The groundwater samples were analyzed for TCL VOCs, calcium, iron, magnesium, manganese, potassium, and the following indicator parameters: TDS, methane/ethane/ethene, nitrate/nitrite, alkalinity, sulfate, chloride, ferrous iron, and phosphate. All monitoring wells were sampled using the EPA Region II Low-Flow Groundwater Sampling Procedures. **Tables 2 through 4** summarize the validated analytical results.

One additional, final round of groundwater monitoring is being completed this week and will be submitted to you along with the previous data, provided to you herein, as part of the final treatability study report.

PARSONS

Parsons appreciates the opportunity to provide you with this data. Should you have any questions, please do not hesitate to call me at (782) 401-2492 to discuss them.

Sincerely,

**PARSONS ENGINEERING SCIENCE, INC.**

Elza Schacht for
Michael Duchesneau, P.E.
Project Manager

cc: Dorothy Richards, CEHND-PM-ND
Randall Battaglia, CENAN
Keith Hoddinott, USACHPPM (PROV.)
John Buck, AEC
Don Williams, CEMRD
Julio Vazquez, USEPA
James Quinn, NYSDEC

**PARSONS ENGINEERING SCIENCE, INC.**

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

January 5, 2000

Mr. Julio Vazquez
U.S. Environmental Protection Agency, Region II
Emergency & Remedial Response Division
290 Broadway, 18th Floor, E-3
New York, NY 10007-1866

Mr. James Quinn
Bureau of Eastern Remedial Action
Division of Hazardous Waste Remediation
New York State Department of Environmental Conservation (NYSDEC)
Room 208
50 Wolf Road
Albany, NY 12233-7010

**SUBJECT: Ash Landfill Reactive Wall Treatability Study**
**Quarterly Groundwater Sampling Results**
**Seneca Army Depot Activity, Romulus, New York**

Dear Mr. Vazquez/Mr. Quinn:

In accordance with Paragraph 24.2 of the Federal Facilities Agreement for this project, Parsons Engineering Science (Parsons) is pleased to submit the results of the initial three rounds of groundwater monitoring, which have been conducted as part of the Ash Landfill Reactive Wall Treatability Study. The treatability study will include four quarters of groundwater monitoring data and monthly water level measurements for one year. The first quarter of groundwater monitoring for the Ash Landfill Treatability Study was conducted between April 26 through 28, 1999; the second quarter was conducted on June 29, 1999; and the third quarter was conducted between September 28 and 29, 1999. This data has been validated.

In addition, water level measurements were performed monthly at 18 monitoring wells at the Ash Landfill site. **Figure 1** shows the locations of the monitoring wells. These monitoring wells include the 11 monitoring wells associated with the reactive iron wall and six additional monitoring wells located upgradient of the wall and one monitoring well located just downgradient of the wall. The groundwater elevation measurements are summarized in **Table 1**.

Groundwater samples were collected from 11 monitoring wells. The groundwater samples were analyzed for TCL VOCs, calcium, iron, magnesium, manganese, potassium, and the following indicator parameters: TDS, methane/ethane/ethene, nitrate/nitrite, alkalinity, sulfate, chloride, ferrous iron, and phosphate. All monitoring wells were sampled using the EPA Region II Low-Flow Groundwater Sampling Procedures. **Tables 2 through 4** summarize the validated analytical results.

One additional, final round of groundwater monitoring is being completed this week and will be submitted to you along with the previous data, provided to you herein, as part of the final treatability study report.

Parsons appreciates the opportunity to provide you with this data. Should you have any questions, please do not hesitate to call me at (782) 401-2492 to discuss them.

Sincerely,

**PARSONS ENGINEERING SCIENCE, INC.**

Eliza Schacht for
Michael Duchesneau, P.E.
Project Manager

cc: Dorothy Richards, CEHND-PM-ND
Randall Battaglia, CENAN
Keith Hoddinott, USACHPPM (PROV.)
John Buck, AEC
Don Williams, CEMRD
Stephen Absolom, SEDA

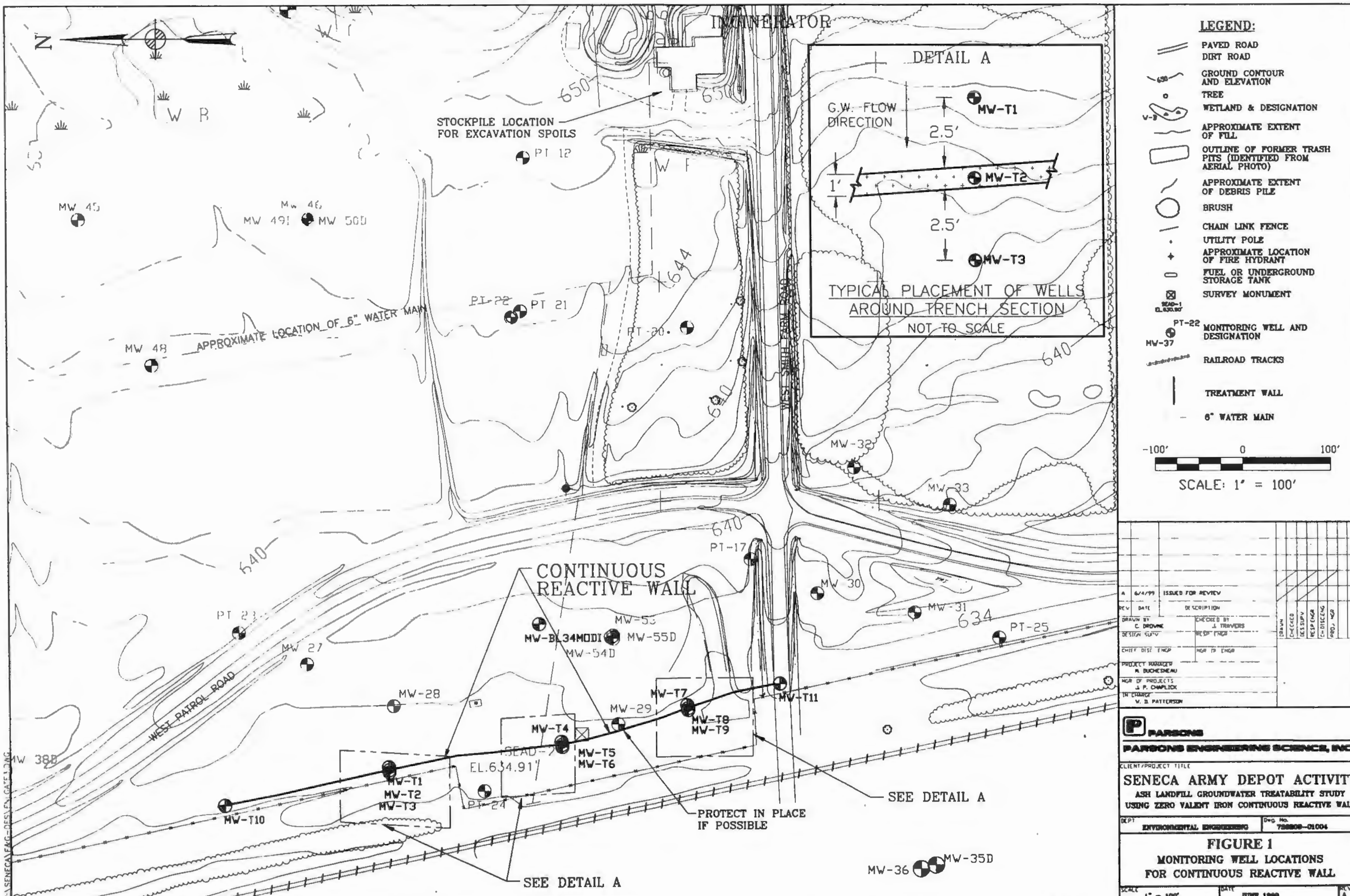

N
INCINERATOR
STOCKPILE LOCATION FOR EXCAVATION SPOILS
W R
W F
PT 12
MW 45
MW 46
MW 49I
MW 50D
PT-22
PT 21
PT-20
MW 48
APPROXIMATE LOCATION OF 6" WATER MAIN
650
644
640
634
WEST SMITH FARM ROAD
DETAIL A
G.W. FLOW DIRECTION
2.5'
1'
MW-T1
MW-T2
MW-T3
TYPICAL PLACEMENT OF WELLS AROUND TRENCH SECTION
NOT TO SCALE
MW-32
MW-33
PT-17
MW-30
MW-31
PT-25
CONTINUOUS REACTIVE WALL
PT 23
MW-BL34MODI
MW-55D
MW-53
MW-54D
MW 27
WEST PATROL ROAD
MW-28
MW-T7
MW-T8
MW-T9
MW-T11
MW-29
MW-T4
SEAD-7
EL.634.91'
MW-T5
MW-T6
MW 38D
MW-T1
MW-T2
MW-T3
PT-24
MW-T10
PROTECT IN PLACE IF POSSIBLE
SEE DETAIL A
SEE DETAIL A
MW-36
MW-35D
LEGEND:
PAVED ROAD
DIRT ROAD
GROUND CONTOUR AND ELEVATION
TREE
WETLAND & DESIGNATION
APPROXIMATE EXTENT OF FILL
OUTLINE OF FORMER TRASH PITS (IDENTIFIED FROM AERIAL PHOTO)
APPROXIMATE EXTENT OF DEBRIS PILE
BRUSH
CHAIN LINK FENCE
UTILITY POLE
APPROXIMATE LOCATION OF FIRE HYDRANT
FUEL OR UNDERGROUND STORAGE TANK
SURVEY MONUMENT
MONITORING WELL AND DESIGNATION
RAILROAD TRACKS
TREATMENT WALL
6" WATER MAIN
-100'
0
100'
SCALE: 1' = 100'
A 6/4/99 ISSUED FOR REVIEW
REV DATE DESCRIPTION
DRAWN BY C. DROWNE
CHECKED BY J. TRAVERS
DESIGN SUPV
RESP ENGR
CHIEF DISC ENGR
MGR OF ENGR
PROJECT MANAGER R. DUCHESNEAU
MGR OF PROJECTS J. P. CHAPLICK
IN CHARGE W. D. PATTERSON
DRAWN CHECKED DES SUPV RESP ENGR CH DISC ENG PROJ MGR
PARSONS
PARSONS ENGINEERING SCIENCE, INC.
CLIENT/PROJECT TITLE
SENECA ARMY DEPOT ACTIVITY
ASH LANDFILL GROUNDWATER TREATABILITY STUDY USING ZERO VALENT IRON CONTINUOUS REACTIVE WALL
DEPT ENVIRONMENTAL ENGINEERING
Dwg. No. 726909-01004
FIGURE 1
MONITORING WELL LOCATIONS FOR CONTINUOUS REACTIVE WALL
SCALE 1" = 100'
DATE JUNE 1999
REV A

Table 1
Seneca Army Depot Activity
Ash Landfill Treatibility Study
Groundwater Elevations - Monthly Measurements

| Monitoring Well | Elevation at Top of Riser (MSL) | April 28, 1999 | | May 28, 1999 | | June 28, 1999 | | July 29, 1999 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Depth from Top of Riser (ft) | Elevation of Water Level (ft) | Depth from Top of Riser (ft) | Elevation of Water Level (ft) | Depth from Top of Riser (ft) | Elevation of Water Level (ft) | Depth from Top of Riser (ft) | Elevation of Water Level (ft) |
| MWT-1 | 637.24 | 5.99 | 631.25 | 5.50 | 631.74 | 6.37 | 630.87 | 8.06 | 629.18 |
| MWT-2 | 637.19 | 5.00 | 632.19 | 5.42 | 631.77 | 6.35 | 630.84 | 8.06 | 629.13 |
| MWT-3 | 637.31 | 5.13 | 632.18 | 5.40 | 631.91 | 6.45 | 630.86 | 8.16 | 629.15 |
| MWT-4 | 637.68 | 5.46 | 632.22 | 6.40 | 631.28 | 8.20 | 629.48 | 10.29 | 627.39 |
| MWT-5 | 637.72 | 5.55 | 632.17 | 6.54 | 631.18 | 8.25 | 629.47 | 10.34 | 627.38 |
| MWT-6 | 637.59 | 5.42 | 632.17 | 6.39 | 631.20 | 8.15 | 629.44 | 10.24 | 627.35 |
| MWT-7 | 638.34 | 6.10 | 632.24 | 7.25 | 631.09 | 9.58 | 628.76 | 11.77 | 626.57 |
| MWT-8 | 638.4 | 6.17 | 632.23 | 7.37 | 631.03 | 9.68 | 628.72 | 11.87 | 626.53 |
| MWT-9 | 638.08 | 5.91 | 632.17 | 7.97 | 630.11 | 9.45 | 628.63 | 11.65 | 626.43 |
| MWT-10 | 636.07 | 6.86 | 629.21 | 4.25 | 631.82 | 5.09 | 630.98 | 6.40 | 629.67 |
| MWT-11 | 635.9 | 2.41 | 633.49 | 4.45 | 631.45 | 7.30 | 628.60 | 8.55 | 627.35 |
| PT-24 | 636.4 | 4.56 | 631.84 | 5.19 | 631.21 | 6.54 | 629.86 | 8.31 | 628.09 |
| MW-29 | 637.31 | 5.76 | 631.55 | 6.79 | 630.52 | 8.80 | 628.51 | dry | dry |
| MW-28 | 637.21 | 4.56 | 632.65 | 5.59 | 631.62 | 6.85 | 630.36 | 8.30 | 628.91 |
| MW-27 | 639.32 | 4.95 | 634.37 | 6.58 | 632.74 | 7.61 | 631.71 | 8.43 | 630.89 |
| MW-53 | 639.41 | 5.87 | 633.54 | 7.65 | 631.76 | 9.70 | 629.71 | dry | dry |
| PT-17 | 640.14 | 4.54 | 635.60 | 7.44 | 632.70 | 9.58 | 630.56 | dry | dry |
| MW-30 | 640.32 | 5.02 | 635.30 | 8.60 | 631.72 | dry | dry | dry | dry |

Table 1
Seneca Army Depot Activity
Ash Landfill Treatibility Study
Groundwater Elevations - Monthly Measurements

| | Elevation at | August 30, 1999 | | September 27, 1999 | | October 29, 1999 | | November 28, 1999 | |
|---|---|---|---|---|---|---|---|---|---|
| Monitoring Well | Top of Riser (MSL) | Depth from Top of Riser (ft) | Elevation of Water Level (ft) | Depth from Top of Riser (ft) | Elevation of Water Level (ft) | Depth from Top of Riser (ft) | Elevation of Water Level (ft) | Depth from Top of Riser (ft) | Elevation of Water Level (ft) |
| MWT-1 | 637.24 | 9.05 | 628.19 | 7.92 | 629.32 | 6.26 | 630.98 | 5.53 | 631.71 |
| MWT-2 | 637.19 | 9.00 | 628.19 | 7.90 | 629.29 | 6.26 | 630.93 | 5.46 | 631.73 |
| MWT-3 | 637.31 | 9.14 | 628.17 | 7.92 | 629.39 | 6.37 | 630.94 | 5.59 | 631.72 |
| MWT-4 | 637.68 | 11.25 | 626.43 | 9.96 | 627.72 | 7.57 | 630.11 | 6.45 | 631.23 |
| MWT-5 | 637.72 | 11.36 | 626.36 | 10.00 | 627.72 | 7.66 | 630.06 | 6.53 | 631.19 |
| MWT-6 | 637.59 | 11.21 | 626.38 | 9.90 | 627.69 | 7.52 | 630.07 | 6.41 | 631.18 |
| MWT-7 | 638.34 | 12.70 | 625.64 | 10.64 | 627.70 | 8.44 | 629.90 | 7.13 | 631.21 |
| MWT-8 | 638.4 | dry | dry | 10.78 | 627.62 | 8.54 | 629.86 | 7.22 | 631.18 |
| MWT-9 | 638.08 | 12.60 | 625.48 | 10.58 | 627.50 | 8.25 | 629.83 | 6.95 | 631.13 |
| MWT-10 | 636.07 | 7.55 | 628.52 | 6.50 | 629.57 | 5.25 | 630.82 | 4.36 | 631.71 |
| MWT-11 | 635.9 | 8.95 | 626.95 | 7.14 | 628.76 | 5.52 | 630.38 | 4.15 | 631.75 |
| PT-24 | 636.4 | 8.20 | 628.20 | 8.04 | 628.36 | 6.10 | 630.30 | 5.04 | 631.36 |
| MW-29 | 637.31 | dry | dry | dry | dry | 8.00 | 629.31 | 6.79 | 630.52 |
| MW-28 | 637.21 | 9.05 | 628.16 | 7.92 | 629.29 | 6.34 | 630.87 | 5.5 | 631.71 |
| MW-27 | 639.32 | 8.70 | 630.62 | 7.14 | 632.18 | 6.60 | 632.72 | 5.21 | 634.11 |
| MW-53 | 639.41 | 10.00 | 629.41 | 9.88 | 629.53 | 8.71 | 630.70 | 7.61 | 631.80 |
| PT-17 | 640.14 | 11.00 | 629.14 | 9.10 | 631.04 | 8.05 | 632.09 | 5.14 | 635.00 |
| MW-30 | 640.32 | dry | dry | dry | dry | 9.57 | 630.75 | 7.27 | 633.05 |

Table 2
Seneca Army Depot Activity
Ash Landfill Treatibility Study
Groundwater Sampling - Round 1

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | |
| | | | MWT-1 | | MWT-10 | | MWT-11 | | MWT-2 | | MWT-3 | | MWT-4 | |
| | | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | |
| | | | TR2002 | | TR2001 | | TR2000 | | TR2008 | | TR2007 | | TR2004 | |
| | | | 8 | | 7 | | 8 | | 11.3 | | 8 | | 10 | |
| | | | 8 | | 7 | | 8 | | 11.3 | | 8 | | 10 | |
| | | NYSDEC | 4/26/1999 | | 4/26/1999 | | 4/26/1999 | | 4/28/1999 | | 4/27/1999 | | 4/26/1999 | |
| | | CLASS GA | SA | | SA | | SA | | SA | | SA | | SA | |
| | | STANDARD | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | |
| **Volatile Organic Compounds** | | | N | | N | | N | | N | | N | | N | |
| 1,1,1-Trichloroethane | UG/L | 5 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| 1,1,2,2-Tetrachloroethane | UG/L | 5 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| 1,1,2-Trichloroethane | UG/L | | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| 1,1-Dichloroethane | UG/L | 5 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| 1,1-Dichloroethene | UG/L | 5 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| 1,2,4-Trichlorobenzene | UG/L | 5 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| 1,2-Dibromo-3-chloropropane | UG/L | | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| 1,2-Dibromoethane | UG/L | | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| 1,2-Dichlorobenzene | UG/L | 4.7 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| 1,2-Dichloroethane | UG/L | 5 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| 1,2-Dichloropropane | UG/L | 5 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| 1,3-Dichlorobenzene | UG/L | 5 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| 1,4-Dichlorobenzene | UG/L | 4.7 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| Acetone | UG/L | | 20 | U | 5 | U | 5 | U | 6 | | 8 | U | 14 | U |
| Benzene | UG/L | 0.7 | 4 | U | 0.7 | J | 1 | U | 0.7 | J | 0.4 | J | 3 | U |
| Bromochloromethane | UG/L | | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| Bromodichloromethane | UG/L | | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| Bromoform | UG/L | | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| Carbon disulfide | UG/L | | 4 | U | 1 | U | 1 | U | 1 | | 2 | U | 3 | U |
| Carbon tetrachloride | UG/L | 5 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| Chlorobenzene | UG/L | 5 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| Chlorodibromomethane | UG/L | | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| Chloroethane | UG/L | 5 | 4 | UJ | 1 | UJ | 1 | UJ | 1 | U | 2 | UJ | 3 | UJ |
| Chloroform | UG/L | 7 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| Cis-1,2-Dichloroethene | UG/L | 5 | 73 | | 6 | | 1 | U | 27 | | 27 | | 49 | |
| Cis-1,3-Dichloropropene | UG/L | 5 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| Ethyl benzene | UG/L | 5 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| Methyl bromide | UG/L | | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| Methyl butyl ketone | UG/L | | 20 | U | 5 | U | 5 | U | 5 | U | 8 | U | 14 | U |
| Methyl chloride | UG/L | 5 | 4 | UJ | 1 | UJ | 1 | UJ | 1 | U | 2 | UJ | 3 | UJ |

Table 2
Seneca Army Depot Activity
Ash Landfill Treatibility Study
Groundwater Sampling - Round 1

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | |
| | | | MWT-1 | | MWT-10 | | MWT-11 | | MWT-2 | | MWT-3 | | MWT-4 | |
| | | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | |
| | | | TR2002 | | TR2001 | | TR2000 | | TR2008 | | TR2007 | | TR2004 | |
| | | | 8 | | 7 | | 8 | | 11.3 | | 8 | | 10 | |
| | | | 8 | | 7 | | 8 | | 11.3 | | 8 | | 10 | |
| | | NYSDEC | 4/26/1999 | | 4/26/1999 | | 4/26/1999 | | 4/28/1999 | | 4/27/1999 | | 4/26/1999 | |
| | | CLASS GA | SA | | SA | | SA | | SA | | SA | | SA | |
| | | STANDARD | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | |
| Methyl ethyl ketone | UG/L | 50 | 20 | U | 5 | U | 5 | U | 5 | U | 8 | U | 14 | U |
| Methyl isobutyl ketone | UG/L | | 20 | U | 5 | U | 5 | U | 5 | U | 8 | U | 14 | U |
| Methylene chloride | UG/L | 5 | 8 | U | 2 | U | 2 | U | 2 | U | 3 | U | 6 | U |
| Styrene | UG/L | | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| Tetrachloroethene | UG/L | 5 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| Toluene | UG/L | 5 | 4 | U | 1 | U | 1 | U | 0.7 | J | 2 | U | 3 | U |
| Total Xylenes | UG/L | 5 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| Trans-1,2-Dichloroethene | UG/L | 5 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| Trans-1,3-Dichloropropene | UG/L | 5 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| Trichloroethene | UG/L | 5 | 23 | | 1 | U | 1 | U | 1 | | 1 | J | 2 | J |
| Vinyl chloride | UG/L | 2 | 4 | U | 1 | U | 1 | U | 1 | U | 2 | U | 3 | U |
| **Metals** | | | | | | | | | | | | | | |
| Calcium | UG/L | | 122000 | | 49900 | | 102000 | | 264000 | | 58000 | | 118000 | |
| Iron | UG/L | 300 | 403 | J | 13100 | J | 54.6 | J | 523000 | J | 3600 | J | 983 | J |
| Magnesium | UG/L | | 13800 | | 10600 | | 12800 | | 60800 | | 13000 | | 14300 | |
| Manganese | UG/L | 300 | 13.2 | J | 191 | | 78 | | 6260 | | 611 | | 37.1 | |
| Potassium | UG/L | | 1460 | J | 1520 | J | 5600 | | 15100 | | 1900 | J | 1860 | J |
| Methane | UG/L | | 1.2 | U | 4.5 | | 4.1 | | 20 | | 7.1 | | 1.2 | U |
| Ethane | UG/L | | 2.1 | U | 6.8 | | 2.1 | U | 8.3 | | 7.8 | | 2.1 | U |
| Ethene | UG/L | | 2.5 | U | 2.5 | U | 2.5 | U | 8.8 | | 9.3 | | 2.5 | U |
| Sulfate | MG/L | | 91.1 | | 51.7 | | 49.7 | | 82 | | 84.2 | | 106 | |
| Nitrate | MG/L | | 0.3 | | <0.2 | | 0.3 | | <0.2 | | <0.2 | | 0.3 | |
| Chloride | MG/L | | 15.2 | | 11.5 | | 11.5 | | 15 | | 15.6 | | 21.5 | |
| TDS | MG/L | | 438 | | 206 | | 366 | | 269 | | 252 | | 441 | |
| pH | | | 7.19 | | 7.54 | | 7.26 | | 7.83 | | 7.41 | | 7.16 | |
| Alkalinity | MG/L | | 266 | | 113 | | 280 | | 378 | | 107 | | 238 | |
| Phosphate | MG/L | | 0.01 | | 0.03 | | 0.01 | | 0.44 | | 0.04 | | 0.04 | |

Table 2
Seneca Army Depot Activity
Ash Landfill Treatibility Study
Groundwater Sampling - Round 1

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | |
| | | | MWT-5 | | MWT-6 | | MWT-6 | | MWT-7 | | MWT-8 | | MWT-9 | |
| | | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | |
| | | | TR2009 | | TR2011 | | TR2006 | | TR2003 | | TR2010 | | TR2005 | |
| | | | 11.1 | | 10.5 | | 10.5 | | 11.5 | | 11.58 | | 12.14 | |
| | | | 11.1 | | 10.5 | | 10.5 | | 11.5 | | 11.58 | | 12.14 | |
| | | NYSDEC | 4/28/1999 | | 4/28/1999 | | 4/28/1999 | | 4/27/1999 | | 4/28/1999 | | 4/27/1999 | |
| | | CLASS GA | SA | | DU | | SA | | SA | | SA | | SA | |
| | | STANDARD | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | |
| **Volatile Organic Compounds** | | | N | | N | | N | | N | | N | | N | |
| 1,1,1-Trichloroethane | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| 1,1,2,2-Tetrachloroethane | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| 1,1,2-Trichloroethane | UG/L | | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| 1,1-Dichloroethane | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| 1,1-Dichloroethene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| 1,2,4-Trichlorobenzene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| 1,2-Dibromo-3-chloropropane | UG/L | | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| 1,2-Dibromoethane | UG/L | | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| 1,2-Dichlorobenzene | UG/L | 4.7 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| 1,2-Dichloroethane | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| 1,2-Dichloropropane | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| 1,3-Dichlorobenzene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| 1,4-Dichlorobenzene | UG/L | 4.7 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Acetone | UG/L | | 7 | | 6 | | 5 | | 110 | U | 16 | | 11 | U |
| Benzene | UG/L | 0.7 | 0.9 | J | 0.7 | J | 0.7 | J | 22 | U | 1 | U | 2 | U |
| Bromochloromethane | UG/L | | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Bromodichloromethane | UG/L | | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Bromoform | UG/L | | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Carbon disulfide | UG/L | | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Carbon tetrachloride | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Chlorobenzene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Chlorodibromomethane | UG/L | | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Chloroethane | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | UJ | 1 | U | 2 | UJ |
| Chloroform | UG/L | 7 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Cis-1,2-Dichloroethene | UG/L | 5 | 0.7 | J | 3 | | 3 | | 20 | J | 1 | U | 32 | |
| Cis-1,3-Dichloropropene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Ethyl benzene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Methyl bromide | UG/L | | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Methyl butyl ketone | UG/L | | 5 | U | 5 | U | 5 | U | 110 | U | 5 | U | 11 | U |
| Methyl chloride | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | UJ | 1 | U | 2 | UJ |

p:\pit\projects\seneca\irontrnc\gwdata\data.xls

Table 2
Seneca Army Depot Activity
Ash Landfill Treatibility Study
Groundwater Sampling - Round 1

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | |
| | | | MWT-5 | | MWT-6 | | MWT-6 | | MWT-7 | | MWT-8 | | MWT-9 | |
| | | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | |
| | | | TR2009 | | TR2011 | | TR2006 | | TR2003 | | TR2010 | | TR2005 | |
| | | | 11.1 | | 10.5 | | 10.5 | | 11.5 | | 11.58 | | 12.14 | |
| | | | 11.1 | | 10.5 | | 10.5 | | 11.5 | | 11.58 | | 12.14 | |
| | | NYSDEC | 4/28/1999 | | 4/28/1999 | | 4/28/1999 | | 4/27/1999 | | 4/28/1999 | | 4/27/1999 | |
| | | CLASS GA | SA | | DU | | SA | | SA | | SA | | SA | |
| | | STANDARD | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | |
| Methyl ethyl ketone | UG/L | 50 | 5 | U | 5 | U | 5 | U | 110 | U | 5 | U | 11 | U |
| Methyl isobutyl ketone | UG/L | | 5 | U | 5 | U | 5 | U | 110 | U | 5 | U | 11 | U |
| Methylene chloride | UG/L | 5 | 2 | U | 2 | U | 2 | U | 44 | U | 2 | U | 4 | U |
| Styrene | UG/L | | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Tetrachloroethene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Toluene | UG/L | 5 | 0.3 | J | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Total Xylenes | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Trans-1,2-Dichloroethene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Trans-1,3-Dichloropropene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| Trichloroethene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 430 | | 1 | U | 43 | |
| Vinyl chloride | UG/L | 2 | 1 | U | 1 | U | 1 | U | 22 | U | 1 | U | 2 | U |
| **Metals** | | | | | | | | | | | | | | |
| Calcium | UG/L | | 177000 | | 44000 | | 43800 | | 122000 | | 40200 | | 36200 | |
| Iron | UG/L | 300 | 548000 | J | 392 | J | 244 | J | 228 | J | 37300 | J | 1010 | J |
| Magnesium | UG/L | | 74400 | | 4970 | J | 4920 | J | 14300 | | 9830 | | 9520 | |
| Manganese | UG/L | 300 | 5010 | | 169 | | 170 | | 22.5 | | 416 | | 444 | |
| Potassium | UG/L | | 14200 | | 2080 | J | 1910 | J | 2030 | J | 6250 | | 1600 | J |
| Methane | UG/L | | 14 | | 9.4 | | 1.2 | U | 3.6 | | 13 | | 6.9 | |
| Ethane | UG/L | | 12 | | 13 | | 2.1 | U | 2.1 | U | 13 | | 14 | |
| Ethene | UG/L | | 8.7 | | 8.7 | | 2.5 | U | 2.5 | U | 8 | | 12 | |
| Sulfate | MG/L | | 107 | | 108 | | 113 | | 74.2 | | 61.6 | | 47.2 | |
| Nitrate | MG/L | | <0.2 | | <0.2 | | <0.2 | | 0.4 | | <0.2 | | <0.2 | |
| Chloride | MG/L | | 23.4 | | 24.6 | | 25.2 | | 8.7 | | 7.6 | | 8.3 | |
| TDS | MG/L | | 219 | | 219 | | 219 | | 433 | | 145 | | 174 | |
| pH | | | 9.14 | | 8.81 | | 8.72 | | 7.17 | | 9.74 | | 7.84 | |
| Alkalinity | MG/L | | 378 | | 23 | | 22 | | 304 | | 378 | | 97 | |
| Phosphate | MG/L | | 0.06 | | 0.05 | | 0.05 | | 0.02 | | 0.26 | | 0.03 | |

Table 3
Seneca Army Depot Activity
Ash Landfill Treatibility Study
Groundwater Analysis - Round 2

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | |
| | | | MWT-1 | | MWT-10 | | MWT-11 | | MWT-2 | | MWT-3 | | MWT-4 | |
| | | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | |
| | | | TR2023 | | TR2020 | | TR2029 | | TR2021 | | TR2022 | | TR2025 | |
| | | | 8.1 | | 7 | | 9.5 | | 8 | | 8 | | 10 | |
| | | | 8.1 | | 7 | | 9.5 | | 8 | | 8 | | 10 | |
| | | NYSDEC | 6/29/1999 | | 6/29/1999 | | 6/29/1999 | | 6/29/1999 | | 6/29/1999 | | 6/29/1999 | |
| | | CLASS GA | SA | | SA | | SA | | SA | | SA | | SA | |
| | | STANDARD | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | |
| **Volatile Organic Compounds** | | | N | | N | | N | | N | | N | | N | |
| 1,1,1-Trichloroethane | UG/L | 5 | 2 | UJ | 1 | UJ | 1 | UJ | 1 | UJ | 1 | UJ | 4 | UJ |
| 1,1,2,2-Tetrachloroethane | UG/L | 5 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| 1,1,2-Trichloroethane | UG/L | | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| 1,1-Dichloroethane | UG/L | 5 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| 1,1-Dichloroethene | UG/L | 5 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| 1,2,4-Trichlorobenzene | UG/L | 5 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| 1,2-Dibromo-3-chloropropane | UG/L | | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| 1,2-Dibromoethane | UG/L | | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| 1,2-Dichlorobenzene | UG/L | 4.7 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| 1,2-Dichloroethane | UG/L | 5 | 2 | UJ | 1 | UJ | 1 | UJ | 1 | UJ | 1 | UJ | 4 | UJ |
| 1,2-Dichloropropane | UG/L | 5 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| 1,3-Dichlorobenzene | UG/L | 5 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| 1,4-Dichlorobenzene | UG/L | 4.7 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Acetone | UG/L | | 4 | J | 3 | J | 5 | U | 5 | | 3 | J | 14 | J |
| Benzene | UG/L | 0.7 | 2 | U | 0.9 | J | 1 | U | 0.6 | J | 1 | U | 4 | U |
| Bromochloromethane | UG/L | | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Bromodichloromethane | UG/L | | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Bromoform | UG/L | | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Carbon disulfide | UG/L | | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Carbon tetrachloride | UG/L | 5 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Chlorobenzene | UG/L | 5 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Chlorodibromomethane | UG/L | | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Chloroethane | UG/L | 5 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Chloroform | UG/L | 7 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Cis-1,2-Dichloroethene | UG/L | 5 | 32 | | 0.7 | J | 1 | U | 6 | | 10 | | 82 | |
| Cis-1,3-Dichloropropene | UG/L | 5 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Ethyl benzene | UG/L | 5 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Methyl bromide | UG/L | | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Methyl butyl ketone | UG/L | | 8 | UJ | 5 | UJ | 5 | UJ | 5 | UJ | 5 | UJ | 21 | UJ |
| Methyl chloride | UG/L | 5 | 2 | UJ | 1 | UJ | 1 | UJ | 1 | UJ | 1 | UJ | 4 | UJ |

Table 3
Seneca Army Depot Activity
Ash Landfill Treatibility Study
Groundwater Analysis - Round 2

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | |
| | | | MWT-1 | | MWT-10 | | MWT-11 | | MWT-2 | | MWT-3 | | MWT-4 | |
| | | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | |
| | | | TR2023 | | TR2020 | | TR2029 | | TR2021 | | TR2022 | | TR2025 | |
| | | | 8.1 | | 7 | | 9.5 | | 8 | | 8 | | 10 | |
| | | | 8.1 | | 7 | | 9.5 | | 8 | | 8 | | 10 | |
| | | NYSDEC | 6/29/1999 | | 6/29/1999 | | 6/29/1999 | | 6/29/1999 | | 6/29/1999 | | 6/29/1999 | |
| | | CLASS GA | SA | | SA | | SA | | SA | | SA | | SA | |
| | | STANDARD | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | |
| Methyl ethyl ketone | UG/L | 50 | 8 | U | 14 | | 5 | U | 7 | | 5 | | 21 | U |
| Methyl isobutyl ketone | UG/L | | 8 | U | 5 | U | 5 | U | 5 | U | 5 | U | 21 | U |
| Methylene chloride | UG/L | 5 | 3 | U | 2 | U | 2 | U | 2 | U | 2 | U | 8 | U |
| Styrene | UG/L | | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Tetrachloroethene | UG/L | 5 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Toluene | UG/L | 5 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Total Xylenes | UG/L | 5 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Trans-1,2-Dichloroethene | UG/L | 5 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Trans-1,3-Dichloropropene | UG/L | 5 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| Trichloroethene | UG/L | 5 | 8 | | 1 | U | 1 | U | 1 | U | 0.8 | J | 2 | J |
| Vinyl chloride | UG/L | 2 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 4 | U |
| **Metals** | | | | | | | | | | | | | | |
| Calcium | UG/L | | 120000 | | 22700 | | 107000 | | 16300 | | 47700 | | 158000 | |
| Iron | UG/L | 300 | 133 | | 1620 | | 553 | | 14100 | | 3190 | | 21 | J |
| Magnesium | UG/L | | 13000 | | 6500 | | 16500 | | 6080 | | 6820 | | 18300 | |
| Manganese | UG/L | 300 | 31 | | 44.6 | | 115 | | 165 | | 467 | | 5.2 | J |
| Potassium | UG/L | | 1590 | J | 1290 | J | 12300 | | 1580 | J | 2750 | J | 1880 | J |
| Methane | UG/L | | 14 | | 63 | | 5.4 | | 310 | | 180 | | 1.2 | U |
| Ethane | UG/L | | 2.1 | U | 10 | | 2.1 | U | 12 | | 9.5 | | 2.1 | U |
| Ethene | UG/L | | 2.5 | U | 2.5 | U | 2.5 | U | 10 | | 2.5 | U | 2.5 | U |
| Sulfate | MG/L | | 60.1 | | 0.7 | | 60.5 | | 5.8 | | 31.9 | | 163 | |
| Nitrate | MG/L | | <0.2 | | <0.2 | | <0.2 | | <0.2 | | <0.2 | | 0.3 | |
| Chloride | MG/L | | 12.7 | | 8 | | 13.8 | | 11.1 | | 12.8 | | 31.7 | |
| TDS | MG/L | | 392 | J | 113 | J | 405 | J | 85 | J | 223 | J | 577 | J |
| pH | | | 7.19 | | 8.43 | | 7.36 | | 9.1 | | 7.68 | | 7.14 | |
| Alkalinity | MG/L | | 264 | | 65 | | 280 | | 48 | | 140 | | 240 | |
| Phosphate | MG/L | | <0.01 | | 0.02 | | 0.03 | | 0.17 | | 0.11 | | <0.01 | |

Table 3
Seneca Army Depot Activity
Ash Landfill Treatibility Study
Groundwater Analysis - Round 2

| | | NYSDEC CLASS GA STANDARD | ASH LANDFILL MWT-5 GROUND WATER TR2024 10 10 6/29/1999 SA ASH TRENCH | | ASH LANDFILL MWT-6 GROUND WATER TR2028 10 10 6/29/1999 SA ASH TRENCH | | ASH LANDFILL MWT-7 GROUND WATER TR2026 10 10 6/29/1999 SA ASH TRENCH | | ASH LANDFILL MWT-8 GROUND WATER TR2030 10 10 6/29/1999 SA ASH TRENCH | | ASH LANDFILL MWT-9 GROUND WATER TR2027 12 12 6/29/1999 SA ASH TRENCH | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Volatile Organic Compounds** | | | N | | N | | N | | N | | N | |
| 1,1,1-Trichloroethane | UG/L | 5 | 1 | UJ | 1 | UJ | 31 | UJ | 2 | UJ | 8 | UJ |
| 1,1,2,2-Tetrachloroethane | UG/L | 5 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| 1,1,2-Trichloroethane | UG/L | | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| 1,1-Dichloroethane | UG/L | 5 | 0.7 | J | 1 | U | 31 | U | 2 | U | 8 | U |
| 1,1-Dichloroethene | UG/L | 5 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| 1,2,4-Trichlorobenzene | UG/L | 5 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| 1,2-Dibromo-3-chloropropane | UG/L | | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| 1,2-Dibromoethane | UG/L | | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| 1,2-Dichlorobenzene | UG/L | 4.7 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| 1,2-Dichloroethane | UG/L | 5 | 1 | UJ | 1 | UJ | 31 | UJ | 2 | UJ | 8 | UJ |
| 1,2-Dichloropropane | UG/L | 5 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| 1,3-Dichlorobenzene | UG/L | 5 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| 1,4-Dichlorobenzene | UG/L | 4.7 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Acetone | UG/L | | 3 | J | 3 | J | 140 | J | 4 | J | 24 | J |
| Benzene | UG/L | 0.7 | 0.8 | J | 0.7 | J | 31 | U | 2 | U | 8 | U |
| Bromochloromethane | UG/L | | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Bromodichloromethane | UG/L | | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Bromoform | UG/L | | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Carbon disulfide | UG/L | | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Carbon tetrachloride | UG/L | 5 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Chlorobenzene | UG/L | 5 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Chlorodibromomethane | UG/L | | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Chloroethane | UG/L | 5 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Chloroform | UG/L | 7 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Cis-1,2-Dichloroethene | UG/L | 5 | 20 | | 17 | | 32 | | 42 | | 150 | |
| Cis-1,3-Dichloropropene | UG/L | 5 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Ethyl benzene | UG/L | 5 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Methyl bromide | UG/L | | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Methyl butyl ketone | UG/L | | 5 | UJ | 5 | UJ | 160 | UJ | 8 | UJ | 42 | UJ |
| Methyl chloride | UG/L | 5 | 1 | UJ | 1 | UJ | 31 | UJ | 2 | UJ | 8 | UJ |

Table 3
Seneca Army Depot Activity
Ash Landfill Treatibility Study
Groundwater Analysis - Round 2

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | |
| | | | MWT-5 | | MWT-6 | | MWT-7 | | MWT-8 | | MWT-9 | |
| | | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | |
| | | | TR2024 | | TR2028 | | TR2026 | | TR2030 | | TR2027 | |
| | | | 10 | | 10 | | 10 | | 10 | | 12 | |
| | | | 10 | | 10 | | 10 | | 10 | | 12 | |
| | | NYSDEC | 6/29/1999 | | 6/29/1999 | | 6/29/1999 | | 6/29/1999 | | 6/29/1999 | |
| | | CLASS GA | SA | | SA | | SA | | SA | | SA | |
| | | STANDARD | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | |
| Methyl ethyl ketone | UG/L | 50 | 5 | U | 5 | U | 160 | U | 8 | U | 42 | U |
| Methyl isobutyl ketone | UG/L | | 5 | U | 5 | U | 160 | U | 8 | U | 42 | U |
| Methylene chloride | UG/L | 5 | 2 | U | 2 | U | 63 | U | 3 | U | 17 | U |
| Styrene | UG/L | | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Tetrachloroethene | UG/L | 5 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Toluene | UG/L | 5 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Total Xylenes | UG/L | 5 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Trans-1,2-Dichloroethene | UG/L | 5 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Trans-1,3-Dichloropropene | UG/L | 5 | 1 | U | 1 | U | 31 | U | 2 | U | 8 | U |
| Trichloroethene | UG/L | 5 | 1 | U | 1 | U | 530 | J | 2 | U | 52 | |
| Vinyl chloride | UG/L | 2 | 1 | | 0.7 | J | 31 | U | 1 | J | 8 | U |
| **Metals** | | | | | | | | | | | | |
| Calcium | UG/L | | 30500 | | 39700 | | 153000 | | 23900 | | 87200 | |
| Iron | UG/L | 300 | 207 | | 145 | | 58.2 | J | 1090 | | 7800 | |
| Magnesium | UG/L | | 15200 | | 6270 | | 17700 | | 16300 | | 17000 | |
| Manganese | UG/L | 300 | 49.8 | | 240 | | 17.7 | | 97.9 | | 1280 | |
| Potassium | UG/L | | 1410 | J | 1780 | J | 1820 | J | 1430 | J | 1870 | J |
| Methane | UG/L | | 41 | | 1.2 | U | 5.8 | | 6.2 | | 18 | |
| Ethane | UG/L | | 13 | | 2.1 | U | 11 | | 18 | | 13 | |
| Ethene | UG/L | | 16 | | 2.5 | U | 18 | | 20 | | 16 | |
| Sulfate | MG/L | | 95.1 | | 86.2 | | 124 | | 88.6 | | 103 | |
| Nitrate | MG/L | | <0.2 | | <0.2 | | 0.6 | | <0.2 | | <0.2 | |
| Chloride | MG/L | | 31.3 | | 29.9 | | 12.5 | | 14.6 | | 13.9 | |
| TDS | MG/L | | 233 | J | 201 | J | 531 | J | 194 | J | 351 | J |
| pH | | | 9.5 | | 8.6 | | 7.06 | | 9.22 | | 7.34 | |
| Alkalinity | MG/L | | 13 | | 25 | | 288 | | 46 | | 184 | |
| Phosphate | MG/L | | 0.03 | | 0.03 | | <.01 | | 0.02 | | 0.02 | |

Table 4
Seneca Army Depot Activity
Ash Landfill Treatibility Study
Groundwater Analysis - Round 3

| | | NYSDEC CLASS GA STANDARD | ASH LANDFILL MWT-1 GROUND WATER TR2040 9 9 9/28/1999 SA ASH TRENCH | | ASH LANDFILL MWT-11 GROUND WATER TR2050 0 0 9/29/1999 SA ASH TRENCH | | ASH LANDFILL MWT-10 GROUND WATER TR2049 8 8 9/28/1999 SA ASH TRENCH | | ASH LANDFILL MWT-2 GROUND WATER TR2041 8.5 8.5 9/28/1999 SA ASH TRENCH | | ASH LANDFILL MWT-3 GROUND WATER TR2042 9.1 9.1 9/29/1999 SA ASH TRENCH | | ASH LANDFILL MWT-4 GROUND WATER TR2051 0 0 9/29/1999 DU ASH TRENCH | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Volatile Organic Compounds** | | | N | | N | | N | | N | | N | | N | |
| 1,1,1-Trichloroethane | UG/L | 5 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| 1,1,2,2-Tetrachloroethane | UG/L | 5 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| 1,1,2-Trichloroethane | UG/L | | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| 1,1-Dichloroethane | UG/L | 5 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| 1,1-Dichloroethene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| 1,2,4-Trichlorobenzene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| 1,2-Dibromo-3-chloropropane | UG/L | | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| 1,2-Dibromoethane | UG/L | | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| 1,2-Dichlorobenzene | UG/L | 4.7 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| 1,2-Dichloroethane | UG/L | 5 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| 1,2-Dichloropropane | UG/L | 5 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| 1,3-Dichlorobenzene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| 1,4-Dichlorobenzene | UG/L | 4.7 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| Acetone | UG/L | | 5 | UJ | 5 | UJ | 15 | UJ | 6 | UJ | 5 | UJ | 14 | UJ |
| Benzene | UG/L | 0.7 | 1 | U | 1 | U | 1 | | 0.8 | J | 1 | U | 3 | U |
| Bromochloromethane | UG/L | | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| Bromodichloromethane | UG/L | | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| Bromoform | UG/L | | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| Carbon disulfide | UG/L | | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| Carbon tetrachloride | UG/L | 5 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| Chlorobenzene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| Chlorodibromomethane | UG/L | | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| Chloroethane | UG/L | 5 | 1 | UJ | 1 | UJ | 1 | UJ | 1 | UJ | 1 | UJ | 3 | UJ |
| Chloroform | UG/L | 7 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| Cis-1,2-Dichloroethene | UG/L | 5 | 6 | | 1 | U | 1 | U | 0.6 | J | 2 | | 39 | |
| Cis-1,3-Dichloropropene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| Ethyl benzene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| Methyl bromide | UG/L | | 1 | UJ | 1 | UJ | 1 | UJ | 1 | UJ | 1 | UJ | 3 | U |
| Methyl butyl ketone | UG/L | | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U | 14 | U |
| Methyl chloride | UG/L | 5 | 1 | U | 1 | UJ | 1 | UJ | 1 | U | 1 | U | 3 | UJ |

Table 4
Seneca Army Depot Activity
Ash Landfill Treatibility Study
Groundwater Analysis - Round 3

| | | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | MWT-1 | | MWT-11 | | MWT-10 | | MWT-2 | | MWT-3 | | MWT-4 | |
| | | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | |
| | | | TR2040 | | TR2050 | | TR2049 | | TR2041 | | TR2042 | | TR2051 | |
| | | | 9 | | 0 | | 8 | | 8.5 | | 9.1 | | 0 | |
| | | | 9 | | 0 | | 8 | | 8.5 | | 9.1 | | 0 | |
| | | NYSDEC | 9/28/1999 | | 9/29/1999 | | 9/28/1999 | | 9/28/1999 | | 9/29/1999 | | 9/29/1999 | |
| | | CLASS GA | SA | | SA | | SA | | SA | | SA | | DU | |
| | | STANDARD | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | |
| Methyl ethyl ketone | UG/L | 50 | 5 | UJ | 5 | UJ | 6 | UJ | 5 | UJ | 5 | UJ | 14 | UJ |
| Methyl isobutyl ketone | UG/L | | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U | 14 | U |
| Methylene chloride | UG/L | 5 | 2 | U | 2 | U | 2 | U | 2 | U | 2 | U | 6 | U |
| Styrene | UG/L | | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| Tetrachloroethene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| Toluene | UG/L | 5 | 1 | U | 1 | U | 0.3 | J | 0.2 | J | 1 | U | 3 | U |
| Total Xylenes | UG/L | 5 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| Trans-1,2-Dichloroethene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| Trans-1,3-Dichloropropene | UG/L | 5 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| Trichloroethene | UG/L | 5 | 2 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| Vinyl chloride | UG/L | 2 | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 3 | U |
| | | | | | | | | | | | | | | |
| **Metals** | | | | | | | | | | | | | | |
| Calcium | UG/L | | 117000 | J | 149000 | J | 7610 | J | 20000 | J | 146000 | J | 90100 | J |
| Iron | UG/L | 300 | 906 | J | 4700 | J | 1170 | J | 1420 | | 68500 | | 117 | |
| Magnesium | UG/L | | 12500 | | 24900 | | 1490 | J | 9260 | | 25500 | | 9610 | |
| Manganese | UG/L | 300 | 21.4 | | 312 | | 17.7 | | 54.6 | | 1780 | | 21.8 | |
| Potassium | UG/L | | 1960 | J | 17100 | | 1200 | J | 3180 | J | 19900 | | 1720 | |
| | | | | | | | | | | | | | | |
| Methane | UG/L | | 110 | | 2.1 | | 2300 | | 200 | | 72 | | 110 | |
| Ethane | UG/L | | 2.1 | U | 2.1 | U | 2.1 | | 2.1 | U | 2.1 | U | 2.1 | U |
| Ethene | UG/L | | 2.5 | U | 2.5 | U | 2.5 | U | 2.5 | U | 2.5 | U | 2.5 | U |
| Sulfate | MG/L | | 46.3 | | 98 | | 0.4 | | 58.7 | | 78.4 | | 61.1 | |
| Nitrate | MG/L | | 0.2 | | <0.2 | | <0.2 | | 0.3 | | <0.2 | | 0.2 | |
| Chloride | MG/L | | 10.9 | | 14.5 | | 8.4 | | 11.2 | | 11.9 | | 26 | |
| TDS | MG/L | | 332 | | 547 | | 38 | | 121 | | 321 | | 275 | |
| pH | | | 7.27 | | 7.03 | | 9.7 | | 9.15 | | 7.5 | | 7.42 | |
| Alkalinity | MG/L | | 254 | | 426 | | 26 | | 34 | | 168 | | 168 | |
| Phosphate | MG/L | | 0.06 | | 13 | | 0.05 | | 0.09 | | 0.05 | | 0.01 | |
| Ferrous Iron | MG/L | | | | 2.55 | | | | | | | | 0.1 | |

Table 4
Seneca Army Depot Activity
Ash Landfill Treatibility Study
Groundwater Analysis - Round 3

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | |
| | | | MWT-4 | | MWT-4 | | MWT-4 | | MWT-5 | | MWT-6 | | MWT-7 | |
| | | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | |
| | | | TR2043 | | TR2043MS | | TR2043MSD | | TR2044 | | TR2045 | | TR2046 | |
| | | | 11 | | 11 | | 11 | | 11 | | 11.7 | | 12.6 | |
| | | | 11 | | 11 | | 11 | | 11 | | 11.7 | | 12.6 | |
| | | NYSDEC | 9/29/1999 | | 9/29/1999 | | 9/29/1999 | | 9/28/1999 | | 9/29/1999 | | 9/28/1999 | |
| | | CLASS GA | SA | | SA | | SA | | SA | | SA | | SA | |
| | | STANDARD | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | |
| **Volatile Organic Compounds** | | | N | | N | | N | | N | | N | | N | |
| 1,1,1-Trichloroethane | UG/L | 5 | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| 1,1,2,2-Tetrachloroethane | UG/L | 5 | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| 1,1,2-Trichloroethane | UG/L | | 3 | U | 5 | | 4 | | 1 | U | 1 | U | 40 | U |
| 1,1-Dichloroethane | UG/L | 5 | 3 | U | 1 | U | 1 | U | 0.5 | J | 0.4 | J | 40 | U |
| 1,1-Dichloroethene | UG/L | 5 | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| 1,2,4-Trichlorobenzene | UG/L | 5 | 3 | U | 5 | | 5 | | 1 | U | 1 | U | 40 | U |
| 1,2-Dibromo-3-chloropropane | UG/L | | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| 1,2-Dibromoethane | UG/L | | 3 | U | 5 | | 5 | | 1 | U | 1 | U | 40 | U |
| 1,2-Dichlorobenzene | UG/L | 4.7 | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| 1,2-Dichloroethane | UG/L | 5 | 3 | U | 5 | | 5 | | 1 | U | 1 | U | 40 | U |
| 1,2-Dichloropropane | UG/L | 5 | 3 | U | 5 | | 5 | | 1 | U | 1 | U | 40 | U |
| 1,3-Dichlorobenzene | UG/L | 5 | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| 1,4-Dichlorobenzene | UG/L | 4.7 | 3 | U | 4 | | 4 | | 1 | U | 1 | U | 40 | U |
| Acetone | UG/L | | 14 | R | 2 | J | 5 | U | 6 | UJ | 5 | UJ | 200 | R |
| Benzene | UG/L | 0.7 | 3 | U | 5 | | 5 | | 0.6 | J | 0.4 | J | 40 | U |
| Bromochloromethane | UG/L | | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| Bromodichloromethane | UG/L | | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| Bromoform | UG/L | | 3 | U | 4 | | 4 | | 1 | U | 1 | U | 40 | U |
| Carbon disulfide | UG/L | | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| Carbon tetrachloride | UG/L | 5 | 3 | U | 4 | | 4 | | 1 | U | 1 | U | 40 | U |
| Chlorobenzene | UG/L | 5 | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| Chlorodibromomethane | UG/L | | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| Chloroethane | UG/L | 5 | 3 | UJ | 1 | U | 1 | U | 1 | UJ | 1 | UJ | 40 | UJ |
| Chloroform | UG/L | 7 | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| Cis-1,2-Dichloroethene | UG/L | 5 | 40 | | 14 | | 14 | | 5 | | 11 | | 25 | J |
| Cis-1,3-Dichloropropene | UG/L | 5 | 3 | U | 5 | | 4 | | 1 | U | 1 | U | 40 | U |
| Ethyl benzene | UG/L | 5 | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| Methyl bromide | UG/L | | 3 | UJ | 1 | U | 1 | U | 1 | UJ | 1 | UJ | 40 | UJ |
| Methyl butyl ketone | UG/L | | 14 | U | 5 | U | 5 | U | 5 | U | 5 | U | 200 | U |
| Methyl chloride | UG/L | 5 | 3 | UJ | 1 | U | 1 | U | 1 | U | 1 | UJ | 40 | UJ |

Table 4
Seneca Army Depot Activity
Ash Landfill Treatibility Study
Groundwater Analysis - Round 3

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | | ASH LANDFILL | |
| | | | MWT-4 | | MWT-4 | | MWT-4 | | MWT-5 | | MWT-6 | | MWT-7 | |
| | | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | | GROUND WATER | |
| | | | TR2043 | | TR2043MS | | TR2043MSD | | TR2044 | | TR2045 | | TR2046 | |
| | | | 11 | | 11 | | 11 | | 11 | | 11.7 | | 12.6 | |
| | | | 11 | | 11 | | 11 | | 11 | | 11.7 | | 12.6 | |
| | | NYSDEC | 9/29/1999 | | 9/29/1999 | | 9/29/1999 | | 9/28/1999 | | 9/29/1999 | | 9/28/1999 | |
| | | CLASS GA | SA | | SA | | SA | | SA | | SA | | SA | |
| | | STANDARD | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | | ASH TRENCH | |
| Methyl ethyl ketone | UG/L | 50 | 14 | UJ | 5 | U | 5 | U | 5 | UJ | 5 | UJ | 200 | UJ |
| Methyl isobutyl ketone | UG/L | | 14 | U | 5 | U | 5 | U | 5 | U | 5 | U | 200 | U |
| Methylene chloride | UG/L | 5 | 6 | U | 2 | U | 2 | U | 2 | U | 2 | U | 80 | U |
| Styrene | UG/L | | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| Tetrachloroethene | UG/L | 5 | 3 | U | 5 | | 5 | | 1 | U | 1 | U | 40 | U |
| Toluene | UG/L | 5 | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| Total Xylenes | UG/L | 5 | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| Trans-1,2-Dichloroethene | UG/L | 5 | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| Trans-1,3-Dichloropropene | UG/L | 5 | 3 | U | 1 | U | 1 | U | 1 | U | 1 | U | 40 | U |
| Trichloroethene | UG/L | 5 | 3 | U | 5 | | 5 | | 1 | U | 1 | U | 480 | |
| Vinyl chloride | UG/L | 2 | 3 | U | 4 | | 4 | | 1 | U | 1 | U | 40 | U |
| | | | | | | | | | | | | | | |
| **Metals** | | | | | | | | | | | | | | |
| Calcium | UG/L | | 90100 | J | | | | | 11900 | J | 37100 | J | 158000 | J |
| Iron | UG/L | 300 | 92.6 | J | | | | | 565 | | 1150 | J | 109 | J |
| Magnesium | UG/L | | 9810 | | | | | | 6090 | | 4990 | J | 17800 | |
| Manganese | UG/L | 300 | 19.4 | | | | | | 32.2 | | .91.6 | | 28.2 | |
| Potassium | UG/L | | 1750 | J | | | | | 1760 | J | 2480 | J | 2180 | J |
| | | | | | | | | | | | | | | |
| Methane | UG/L | | 140 | | | | | | 750 | | 63 | | 1.2 | |
| Ethane | UG/L | | 2.1 | U | | | | | 2.3 | | 2.1 | U | 2.1 | U |
| Ethene | UG/L | | 2.5 | U | | | | | 4.2 | | 2.5 | U | 2.5 | U |
| Sulfate | MG/L | | 54.2 | | | | | | 25.9 | | 46.5 | | 111 | |
| Nitrate | MG/L | | 0.2 | | | | | | <0.2 | | <0.2 | | 0.4 | |
| Chloride | MG/L | | 25.3 | | | | | | 18.1 | | 19.2 | | 14.1 | |
| TDS | MG/L | | 268 | | | | | | 84 | | 149 | | 536 | |
| pH | | | 7.5 | | | | | | 9.56 | | 7.81 | | 7.18 | |
| Alkalinity | MG/L | | 136 | | | | | | 34 | | 69 | | 336 | |
| Phosphate | MG/L | | 0.01 | | | | | | 0.03 | | 0.05 | | <.01 | |
| Ferrous Iron | MG/L | | | | | | | | | | 0.13 | | | |

Table 4
Seneca Army Depot Activity
Ash Landfill Treatibility Study
Groundwater Analysis - Round 3

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | ASH LANDFILL | | ASH LANDFILL | |
| | | | MWT-8 | | MWT-9 | |
| | | | GROUND WATER | | GROUND WATER | |
| | | | TR2047 | | TR2048 | |
| | | | 11.8 | | 13.5 | |
| | | | 11.8 | | 13.5 | |
| | | NYSDEC | 9/28/1999 | | 9/29/1999 | |
| | | CLASS GA | SA | | SA | |
| | | STANDARD | ASH TRENCH | | ASH TRENCH | |
| **Volatile Organic Compounds** | | | N | | N | |
| 1,1,1-Trichloroethane | UG/L | 5 | 1 | U | 4 | U |
| 1,1,2,2-Tetrachloroethane | UG/L | 5 | 1 | U | 4 | U |
| 1,1,2-Trichloroethane | UG/L | | 1 | U | 4 | U |
| 1,1-Dichloroethane | UG/L | 5 | 1 | U | 4 | U |
| 1,1-Dichloroethene | UG/L | 5 | 1 | U | 4 | U |
| 1,2,4-Trichlorobenzene | UG/L | 5 | 1 | U | 4 | U |
| 1,2-Dibromo-3-chloropropane | UG/L | | 1 | U | 4 | U |
| 1,2-Dibromoethane | UG/L | | 1 | U | 4 | U |
| 1,2-Dichlorobenzene | UG/L | 4.7 | 1 | U | 4 | U |
| 1,2-Dichloroethane | UG/L | 5 | 1 | U | 4 | U |
| 1,2-Dichloropropane | UG/L | 5 | 1 | U | 4 | U |
| 1,3-Dichlorobenzene | UG/L | 5 | 1 | U | 4 | U |
| 1,4-Dichlorobenzene | UG/L | 4.7 | 1 | U | 4 | U |
| Acetone | UG/L | | 5 | UJ | 20 | R |
| Benzene | UG/L | 0.7 | 0.3 | J | 4 | U |
| Bromochloromethane | UG/L | | 1 | U | 4 | U |
| Bromodichloromethane | UG/L | | 1 | U | 4 | U |
| Bromoform | UG/L | | 1 | U | 4 | U |
| Carbon disulfide | UG/L | | 1 | U | 4 | U |
| Carbon tetrachloride | UG/L | 5 | 1 | U | 4 | U |
| Chlorobenzene | UG/L | 5 | 1 | U | 4 | U |
| Chlorodibromomethane | UG/L | | 1 | U | 4 | U |
| Chloroethane | UG/L | 5 | 1 | UJ | 4 | UJ |
| Chloroform | UG/L | 7 | 1 | U | 4 | U |
| Cis-1,2-Dichloroethene | UG/L | 5 | 7 | | 38 | |
| Cis-1,3-Dichloropropene | UG/L | 5 | 1 | U | 4 | U |
| Ethyl benzene | UG/L | 5 | 1 | U | 4 | U |
| Methyl bromide | UG/L | | 1 | UJ | 4 | UJ |
| Methyl butyl ketone | UG/L | | 5 | U | 20 | U |
| Methyl chloride | UG/L | 5 | 1 | U | 4 | UJ |

Table 4
Seneca Army Depot Activity
Ash Landfill Treatibility Study
Groundwater Analysis - Round 3

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | ASH LANDFILL<br>MWT-8<br>GROUND WATER<br>TR2047<br>11.8<br>11.8<br>9/28/1999<br>SA<br>ASH TRENCH | | ASH LANDFILL<br>MWT-9<br>GROUND WATER<br>TR2048<br>13.5<br>13:5<br>9/29/1999<br>SA<br>ASH TRENCH | |
| | | NYSDEC CLASS GA STANDARD | | | | |
| Methyl ethyl ketone | UG/L | 50 | 9 | UJ | 20 | UJ |
| Methyl isobutyl ketone | UG/L | | 5 | U | 20 | U |
| Methylene chloride | UG/L | 5 | 2 | U | 8 | U |
| Styrene | UG/L | | 1 | U | 4 | U |
| Tetrachloroethene | UG/L | 5 | 1 | U | 4 | U |
| Toluene | UG/L | 5 | 1 | U. | 4 | U |
| Total Xylenes | UG/L | 5 | 1 | U | 4 | U |
| Trans-1,2-Dichloroethene | UG/L | 5 | 1 | U | 4 | U |
| Trans-1,3-Dichloropropene | UG/L | 5 | 1 | U | 4 | U |
| Trichloroethene | UG/L | 5 | 1 | U | 56 | |
| Vinyl chloride | UG/L | 2 | 1 | U | 4 | U |
| | | | | | | |
| **Metals** | | | | | | |
| Calcium | UG/L | | 13500 | J | 46700 | J |
| Iron | UG/L | 300 | 6590 | | 889 | J |
| Magnesium | UG/L | | 12600 | | 11500 | |
| Manganese | UG/L | 300 | 120 | | 538 | |
| Potassium | UG/L | | 2020 | J | 2870 | J |
| | | | | | | |
| Methane | UG/L | | 74 | | 120 | |
| Ethane | UG/L | | 3.1 | | 7.4 | |
| Ethene | UG/L | | 8.8 | | 15 | |
| Sulfate | MG/L | | 48.5 | | 44.6 | |
| Nitrate | MG/L | | <0.2 | | <0.2 | |
| Chloride | MG/L | | 10.9 | | 12.2 | |
| TDS | MG/L | | 120 | | 194 | |
| pH | | | 9.4 | | 7.68 | |
| Alkalinity | MG/L | | 50 | | 132 | |
| Phosphate | MG/L | | 0.04 | | 0.03 | |
| Ferrous Iron | MG/L | | | | 0.62 | |

PARSONS ENGINEERING SCIENCE, INC. • 30 DAN ROAD • CANTON, MA 02021

# FACSIMILE COVER SHEET

File
Ash LF
Treatabi

**To:** Mr. Steve Absolom
**Company:** SEDA

**Phone:** (607) 869-1309
**Fax:** (607) 869-1362

**From:** M. Duchesneau
**Company:** Parsons Engineering Science
**Phone:** (781) 401-2492
**Fax:** (781) 401-2043
**Job No.:** 34978

**Date:** February ~~9~~ 10, 1999
**Pages including this cover page:** 22

Steve:

Please see the attached responses to USEPA and NYSDEC comments on the Treatability Study Work Plan for the Zero Valence Iron Continuous Reactive Wall. The revised document will be forwarded to you in the next few days.

Please call me if you have any questions.

Mike.

**PARSONS INFRASTRUCTURE & TECHNOLOGY GROUP INC.**

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

February 9, 1999

Ms. Carla Struble, P.E.
Emergency and Remedial Response Division
USEPA, Region II
290 Broadway, 18 Floor
New York, NY 10007

Mr. James Quinn
Bureau of Eastern Remedial Action
Division of Hazardous Waste Remediation
New York State Department of Environmental Conservation
50 Wolf Road
Albany, NY 12233-7010

**Subject:** **Response to Comments on the Workplan for Treatability Study for Zero Valence Iron Continuous Reactive Wall at the Ash Landfill Site and Proposed Modifications to the Groundwater Sampling Plan in Support of the Treatability Study, Seneca Army Depot Activity**

Dear Ms. Struble and Mr. Quinn:

This letter is in response to comments received from the New York State Department of Environmental Conservation (NYSDEC), dated December 21, 1998 and USEPA, dated January 22, 1999. The letter also summarizes the proposed modifications to the treatability study work plan for zero valence continuous reactive wall at the Ash Landfill site. Parsons Engineering Science (Parsons ES) has prepared responses to comments. Envirometal Technologies Inc. (ETI) has also provided responses to some of NYSDEC's comments. ETI is the licensee for the reactive iron technology and was involved in the design and installation of the continuous reactive wall at the Seneca Army Depot Activity (SEDA).

The 650-foot long reactive wall was successfully installed during the week of December 7 through December 12, 1998, in accordance with the treatability study workplan. Monitoring of the reactive wall, including the installation of several monitoring wells remains as the only field task to be completed.

A workplan describing the proposed installation and monitoring of a continuous, permeable, reactive wall was submitted for review on November 8, 1998. Details of the reactive wall installation process and the monitoring program, including the location, the number, and the sampling frequency of proposed monitoring well network were included in the workplan. Comments, dated December 21, 1998, from the NYSDEC have identified concerns over the proposed monitoring program. EPA representatives indicated during a December 8, 1998 phone conference call that the tasks described in the workplan regarding the wall installation and monitoring were adequate for the proposed program. The installation of the proposed monitoring wells has been delayed until these comments can be mutually resolved. Resolution of these concerns and initiation of the monitoring program is essential since approximately two months of groundwater has flowed through the reactive wall. Monitoring wells, required to monitor the effectiveness of the reactive wall, were to be installed immediately after the installation of the continuous reactive wall was completed.

A network of eight (8) new monitoring wells was originally proposed to be installed to provide data for evaluating the effectiveness of the continuous reactive wall. Two (2) clusters of three (3) monitoring wells were to have been installed at two locations, approximately equidistant from the ends of the reactive barrier wall. At each cluster location, one monitoring well was to have been installed approximately five feet upgradient of the barrier wall. A second well was to have been installed at the downgradient end of the reactive iron, within the reactive iron. The third monitoring well was to have been installed approximately five feet downgradient of the wall. Additional wells, one at each end of the trench, was to have completed the monitoring network. Over the next year, groundwater quality samples were to have been periodically collected at three, six and twelve month intervals to provide an indication of the reactive wall's effectiveness. An anticipated decrease compared to the influent concentration was to have provided the evidence that the process is performing as expected. Piezometric head measurements will also be collected to observe the hydraulic behavior of the reactive barrier wall, including the changes of the water table.

The proposed changes to the sampling and monitoring plan are:

1. NYSDEC has requested that an additional cluster of three wells be installed in the location of the reactive wall and that one cluster location be shifted further to the south where higher chlorinated solvent concentrations have been detected. SEDA has agreed to provide these wells. Therefore, a total of 11 new wells will be installed for monitoring. SEDA has also decided to move the wells within each cluster closer together (spaced 2.5 feet apart rather than the originally proposed 5-foot spacing) to be able to observe in a more timely manner, decreases in compound concentrations which should occur due to the reaction with the iron filings within the wall.

2. NYSDEC has requested that the sampling frequency outlined in ITRC's <u>Regulatory Guidance for Permeable Barrier Walls Designed to Remediate Chlorinated Solvents,</u> be implemented. If not, justification should be provided for modifying the frequency offered in this guidance. SEDA maintains that the frequency originally proposed is sufficient and offers proper justification in its response to comments. Three sampling events will be performed for the collection of VOCs and degradation products. The collection of inorganic constituents has been increased from two events to three events. The timing of the sampling events has been modified slightly from the original plan. Wells will be sampled initially after installation, four months after installation, and nine months after installation.

3. USEPA requested that wells installed within the reactive iron wall be installed using direct push methods rather than conventional installation methods as originally proposed. SEDA agrees with this proposal and will use direct push methods to install these wells so that the reactive iron is not excessively disturbed.

These work plan changes as well as responses to the remaining NYSDEC and USEPA comments are described in further detail in the response to comments included in Appendix G of the revised Treatability Study Work Plan enclosed.

We would appreciate your consensus on the monitoring well locations at your earliest convenience so that we may install the wells and begin the initial round of sampling. Should you have any questions, please do not hesitate to call me at (781) 401-2492 to discuss them.

Sincerely,

**PARSONS ENGINEERING SCIENCE, INC.**

Michael Duchesneau, P.E.
Project Manager

cc: A. Allen
R. Battaglia
K. Hoddinott
S. Absolom
J. Buck
S. Wyte

**Response to the NYSDEC Comments on the Treatability Study Work Plan for Zero Valence Iron Continuous Reactive Wall at the Ash Landfill Comments dated December 21, 1998**

**General Comment #1, Paragraph #1 :** A basic premise offered in the argument for a continuous wall design is that "according to ETI, iron which is subjected to unsaturated conditions show negligible oxidation..." We are unwilling to accept this without evidence. Anecdotal information regarding other projects raises concerns that iron which is subjected to wet dry cycles in the presence of oxygen may experience significant oxidation. If the iron becomes oxidized and the wall becomes less permeable, channel flow within the wall will lead to increased groundwater flow velocities and decreased residence time for the groundwater within the treatment system. This could lead to breakthrough of contamination. A less permeable wall may also increase the head differential across the wall also leading to contaminant breakthrough.

**Parsons ES's Response to General Comment #1, Paragraph #1 :** We are unaware of the anecdotal information that NYSDEC is referring to that have had iron clogging due to premature oxidation and therefore cannot fully address the specific problems that this site may be experiencing. Since the technology is relatively new, there are relatively few documented evaluations of reactive barrier wall to address the concern regarding the long-term behavior of the reactive material. Since ETI is the only licensee of this technology data, ETI is one of the best sources of available data that can be used to address the long-term effectiveness of this technology. The effect of a fluctuating water table was discussed with ETI on several occasions and was not identified by ETI as being a significant cause of iron fouling. ETI's experience at other sites suggests that fouling of the iron bed is predominated by calcium carbonate precipitation, not oxidation of the reactive iron. Since the iron is buried and not exposed to strong oxidizing conditions, the rate of oxidation appears to be less than what would be expected. Perhaps water with low dissolved oxygen is less problematic than iron placed at the surface, which would be attacked by water with high dissolved oxygen content.

Parsons ES has reviewed dissolved oxygen (DO) data measured recently as part of the third quarter groundwater monitoring at the Ash Landfill for 1998. The DO levels in several monitoring wells were generally low, ranging from 0.8 mg/L to 3.55 mg/L. Most DO was in the 1 mg/L range, with only two wells above 2 mg/L. Total alkalinity, as calcium carbonate, ranged from 212 mg/L to 656 mg/L during this last round of monitoring. ETI provided recent studies, performed by ETI, to support their position. O'Hannesin and Gillham (1998), has provided long-term monitoring data, including core samples, for a site in Borden, Ontario (see Groundwater Vol. 36, No.1, January-February 1998). During this study, core samples were obtained from a continuous, permeable, reactive barrier wall after four years of operation. Trace amounts of iron oxides, as well as iron and calcium carbonates were found in the first few millimeters of the upgradient face of the reactive wall but there was no evidence of cementation or precipitation. The report concluded that after four years of successful chlorinated organic treatment, continual performance should be maintained for at least another five years.

The water table at this site varied seasonally between about 2 and 3 meters below the ground surface. Dissolved oxygen at the Ontario site was similar to the Ash Landfill site, ranging at the Ontario site from between 2.5 and 5 mg/L. Upgradient of the reactive wall, the DO was determined to be 3.4 mg/L. The upgradient alkalinity concentration, expressed as calcium carbonate, was determined to be 277 mg/L.

More recent data was prepared and presented at The First International Conference on Remediation of Chlorinated and Recalcitrant Compounds, May 18-21, 1998. Vol. C1-6, Battelle Press, Columbus, Ohio, entitled "Inorganic and Biological Evaluation of Cores from Permeable Iron Reactive Barriers" by ETI. ETI obtained reactive iron core samples from two sites where reactive iron trenches that have been operating for approximately 2 years. One of the trenches evaluated was in New York State. The investigation observed that a decrease of approximately 10% porosity in the reactive media was noted in the first few cm of the media, declining sharply over the first 0.3 m to below 2%. The reactive barrier was expected to perform adequately for several more years before replacement was considered necessary. As with the previous study, some calcium and iron carbonate precipitation was determined to be present but no significant reduction in effectiveness due to oxide precipitation was noted. Since these two sites have similar groundwater chemistry, cementation of the reactive iron was not expected to cause poor performance at the Ash Landfill any more than it had at the Ontario site or the New York site.

Since the effort at the Ash Landfill is a treatability study, the goal of the program is to collect the data that will determine the effectiveness of the reactive barrier wall. Factors that may adversely affect the reactive wall performance, such as oxidation, will be observed in either the chemical data or groundwater piezometeric head data.

**ETI's Response to General Comment #1** Many of the 36 field installations, over the past 4 years, contain iron in the zone of groundwater table fluctuation. This includes a pilot-scale installation near Syracuse, New York, which was cored by ETI and the site consultant 26 months after installation (Vogan et al. 1998). Both vertical and angled cores of the iron material were taken to examine oxidation and inorganic precipitate formation. No evidence of significant oxidation and/or cementation of the iron grains were observed in the zone of fluctuating watertable or elsewhere in the cores. The iron in the fluctuating watertable zone was visually inspected at the time of coring and appeared granular and black in colour, similar to the original iron place in the ground. The back colour is due to a maghemite ($Fe_2O_3$) coating on the iron surface which is also present on the surface of unused iron. Groundwater flow measurements and VOC analyses were performed during the same period prior to coring. These results indicated that the iron was performing the same as when the system was first installed.

It is also worth mentioning supplementary testing of sample of iron from an iron pile that was not used during construction of the pilot treatment system. This iron pile was left unprotected at ground surface. During one of ETI's trips to the site, about 15 months after installation, a sample of this iron was brought back and tested in the laboratory at the University of Waterloo. Batch tests indicated that this "exposed" iron was still reactive in degrading VOCs. Odziemkowski and Gillham (1997) explain that maghemite ($Fe_2O_3$) produced by oxidation of iron can undergo autoreduction to magnetite ($Fe_3O_4$) and that magnetite is broadly excepted as a good electron conductor which should not adversely influence the rate of VOC degradation. Iron covered by soil should be exposed to considerably less atmospheric oxygen than iron at ground surface.

Groundwater modeling of continuous permeable walls indicate that even treatment walls which are a few order of magnitude lower in hydraulic conductivity that the native aquifer are effective in capturing and treating groundwater plumes. For example, Garon et al (1998) showed that a 700 ft long by 1 ft wide PRB with a hydraulic conductivity two orders of magnitude less than the native aquifer would capture a plume 600 ft wide. Thus only groundwater within about 50 ft of either end was diverted around the system. Considering that groundwater will flow through the path of least resistance and that the entire treatment system depth at the Ash Landfill is 11 ft or less, it is likely that in the worst case no more than about 10 to 20 feet of groundwater on either end would be diverted around the treatment system. This is because the iron that is fully saturated over the entire year should be more permeable than the iron in the fluctuating watertable zone.

**General Comment #1, Paragraph #2 :** Review of available guidance for permeable barrier walls, including the document referenced in Section 5.0, has revealed the importance of site specific designs including batch and column studies involving the groundwater and the specific iron ore to be used for construction of the wall. While granting that ETI is expert on this technology, we are concerned with the lack of detailed support for the design parameters offered in the work plan. For example, Battelle notes in *Design Guidance for Application for Permeable Barriers to Remediate Dissolved Chlorinated Solvents, February 1997*, that "observations at a test site in New Jersey have shown that the degradation rate (of TCE) declines by a factor of 2 to 2.5 at temperatures of 8 to 10 degrees Centigrade compared with laboratory rates." (Page 41). When calculating the residence time needed, did ETI allow that the Ash Landfill plume, at the shallow depth in a cold region, is likely to have a low temperature for significant portions of the year?

**Parsons ES's Response to General Comment #1, Paragraph #2 :** Batch and column studies were not necessary as the groundwater conditions were not deemed to be beyond what could be modeled or what would be a concern from previous experiences. Parsons ES, in consultation with ETI, believes that the numerous ETI applications of this technology was sufficient to justify the ETI design model that has been correlated to numerous batch, column and field studies. This model was to determine the reactive iron volume and the required retention time. The ETI model has been used as the basis for numerous successful reactive wall configurations. Site-specific groundwater chemistry and flow data, including alkalinity and hardness data, was provided by Parsons ES to ETI for their review. ETI determined that the concentrations of the constituents such as alkalinity were not unusual compared to other experiences. There was no technical justification to incur the added costs and schedule delays for conducting such studies.

The guidance referred to in the comment also indicates that "Caution should be exercised in interpreting the results of accelerated column tests. Equating 100 pore volumes at 20 feet/day in the laboratory with 1,000 pore volumes at 2 feet/day in the field may not provide an exact estimate, because the lower residence time in the accelerated column test may underestimate the amount of precipitation." For these reasons, a batch and/or a column study was not proposed, instead actual data collected from one trench at the toe of the plume was felt be more valuable in determining the actual performance of the technology.

The affect of temperature on the rate of reaction was considered by ETI in the modeling, as is described in their response to this comment below. Although temperature changes of the groundwater may be a factor that could decrease the effectiveness of the reactive material, a safety factor has been incorporated it the design to account for this. Actual temperature variation in the groundwater at the Ash Landfill has not been well documented but generally the temperature of groundwater, below the frost line, remains consistently between 45°F and 55°F.

**ETI's Response to General Comment #1 :** ETI provided information and guidance for both the ITRC (ITRC, 1997) and Battelle (Gavaskar et al. 1998) documents. While we agree that at many sites bench-scale testing is important, it is also important to recognize that these documents are guidance documents. Site specific design and monitoring plans should be based on the judgment and experience of the design team at the site. In addition, it is important to recognize that the Battelle document was originally drafted in February 1997. At that time, only 11 of the current 36 pilot and full-scale systems using the iron technology had been installed with only about two years of operation at the first site. Since February 1997, several full-scale systems ( including the Seneca Army Depot system) did not have bench-scale testing performed as part of the design. The knowledge and application of the iron technology and other in-situ technologies has grown tremendously in the past two years.

The half-lives chosen to determine the residence time needed to degrade the VOCs at the Seneca Army Depot were representative values from ETI's database of over 100 column tests of commercial site waters. These bench-scale half-lives were doubled to account for lower field temperatures of about 10°C (Battelle, 1998). The water temperature in this above-ground reactor in New Jersey was 6° to 12°C and was influenced by the surrounding ambient temperatures measured at between -6° and 11°C (US EPA, 1997). In-situ the groundwater should not decline in temperatures as low as an above-ground system. Therefore, a temperature correction of two is generally applied at most sites.

**General Comment #1, Paragraph #3 :** The proposed placement of the new monitoring wells will leave approximately 200 feet of reactive wall between each well cluster. Because of the above concerns, additional monitoring points are needed to confidently determine that the reactive wall is performing as required throughout its length. At a minimum, an additional cluster appears needed between MW-29 and the southern extent of the trench, as this location of the trench appears most likely to encounter elevated levels of contamination. Other monitoring locations may be designed with an eye toward also gathering necessary hydraulic information (see Specific Comment below regarding Section 5.0).

**Response to General Comment #1, Paragraph #3 :** The known plume, as depicted by Figure 1 of the workplan, identifies a zone of groundwater with concentrations above 100 ug/L. Although the overall plume direction is east to west, following the established groundwater gradients, this zone of higher concentration does have a slight southerly trend. The monitoring well network will be modified by moving the southernmost cluster of three wells to the south, to within the lobe of the plume of higher concentrations. The northernmost cluster of three wells will also be moved to the south, to the centerpoint of the plume at a location near the edge of the zone of higher concentration. Characterization of the reactive wall's effectiveness will be obtained from the two-upgradient and downgradient clusters. To minimize additional costs, one additional well cluster, placed to the north of the two others (see Figure 3 of the revised work plan), will be sufficient to provide assurance that the trench is providing sufficient destruction. This location is within the portion of the plume that is of lesser concentration than that shown to the south.

Each upgradient and downgradient monitoring well will be installed as close as possible to the reactive wall without disturbing the zero valence iron. We anticipate that each well will be placed to within 2.5 feet of the reactive material.

We agree to modify the placement of the monitoring wells as follows: one well cluster will be moved to the south to a location that will monitor the highest zone of groundwater contamination. The second cluster will be placed within the midpoint of the trench. One additional well cluster will be added to the north.

Finally, we propose to move the three upgradient and three downgradient monitoring wells closer to the trench, by approximately 2.5 feet. This will decrease the travel time necessary before changes in concentrations can be observed.

**General Comment #1, Paragraph #4 :** Core samples of the iron wall should be taken shortly after installation and periodically thereafter. The initial cores will provide construction quality assurance to confirm the quantity and distribution of iron throughout the wall as well as to establish a baseline against which to measure the later core samples. The later cores will provide information as to whether the physical properties of the wall are changing with time and exposure (e.g.; oxidation of the iron, fouling of the wall with precipitates, etc.) in ways detrimental to the system's required performance.

**Parsons ES's Response to General Comment #1, Paragraph #4 :** While we agree that core samples can be collected after the trench has been operating for a year, we disagree with the need to collect iron core samples shortly after the installation or periodically thereafter. Monitoring of the installation process was closely watched and we did not experience "bridging" of the sand/iron mixture as evidenced by the volume of iron that was placed in the trench. We believe that since the wall is only 14 inches thick, core samples can affect the hydraulic performance of the wall. We would consider coring if there is a drop in the hydraulic behavior of the wall. At this point there would be a good indicator of cementation or clogging and coring would be used to confirm that such a condition does exist.

**ETI's Response to General Comment #1, Paragraph #4 :**

Initial coring of the permeable reactive barrier could be done to verify the dimensions and distribution of the iron. Additional coring could be performed every few years to determine the accumulation of precipitates. However, data obtained from strategically placed monitoring wells may be more cost effective and allow for more frequent observation of wall performance. For instance, slug tests performed in the iron zone could be conducted to evaluate significant permeability changes (if any) over time. Changes in flow gradients from perpendicular to the PRB to some angle parallel to the PRB could also indicate changes in permeability.

**Specific Comments**

**Section 3.0:** It is stated that the entity which holds the license design for this technology, ETI, "has provided a summary of similar projects" and "these reports have provided useful information pertaining to the design and construction of the continuous wall system". The work plan should include the "useful information pertaining to the design and construction" of this treatability study, as appropriate. This section also notes that zero valence technology has been recently installed and successful "at a site in New York". As the reference apparently is intended to support the use of this technology, the document should provide at least basic information such as the name of the site and a summary of evidence.

**Response:** Agreed. The reference material will be added to the Work Plan in Appendix B.

**Section 4.1:** Placing potentially contaminated soil from the excavation onto the constructed wall may lead to percolation of contaminated water into the trench in a manner which may not allow for adequate residence time within the trench before exiting. This could lead to contaminated water getting past the trench. Another concern is that infiltration of heavy rains and snowmelt through the relatively porous top of the constructed wall may cause mounding and an increase in the groundwater flow velocities within the trench. This may also lead to contaminant breakthrough and flow of contaminated water around the ends of the trench. To prevent this, an impermeable barrier should be placed above the zero valence iron wall.

**Parsons ES's Response:** The soil, which was excavated during construction and used as backfill for the trench, was analyzed for TCL Volatile Organic Compounds prior to placing the soil into the trench. A 24-hour turnaround time from the laboratory was required to avoid delaying the progress of the construction. The results indicated that TCE was present at levels of approximately 160 ug/kg. Soil was backfilled as the concentration was less than the TAGM value of 700 ug/kg. Soil that was not backfilled was stockpiled, under cover, until a reuse can be found.

Backfill material for the trench was placed above the reactive media following the placement of a geosynthetic filter fabric above the reactive media. The soil excavated during the construction of the trench, consisting of clayey till, was compacted and reused for this purpose. Parsons ES does not believe that an additional impermeable barrier was necessary, since there was no reason to assume infiltration above the trench will be greater at the trench than at any other location at the site. Since the entire area is covered with thick grass and shrubs, migration of surface water over the land to the reactive barrier trench was not deemed likely. An impermeable barrier of bentonite was placed above the trench in the location where the trench crossed the drainage ditch at West Smith Farm Road. A drainage culvert was also placed above the impermeable barrier to further divert and control surface water away from seeping directly into the trench.

It was felt that the added cost of placing the impermeable barrier over the top of the entire 650 feet of the wall was unnecessary. Water that would have been diverted from moving vertically into the trench would move horizontally, beyond the limits of the impermeable barrier, and then move vertically through the adjacent natural soil. Eventually, the infiltrating water will combine with groundwater and seep into the trench. The placement of an impermeable barrier above the reactive media would not remove water from infiltrating, only divert the water. This could be a problem if the trench was expected to be subjected to a large surface water flow but, other than the drainage ditch, this was not considered to be likely. The amount of rainfall acting on the 14 inch wide strip of soil above the reactive material is not considered to be enough to cause a significant mounding affect in the trench beyond what increases in groundwater elevations will occur over the site as precipitation infiltrates. Infiltrating water that seeps into the trench will be expected to be of a lower concentration than the migrating groundwater. When mixed with the existing groundwater the concentration of the groundwater will may have less of an effect on the reactive material.

**Section 4.2:** The wall is apparently designed to address contaminant levels detailed in Table 1 of the work plan. It should be explained why the design does not address levels of contamination at the Ash Landfill that are significantly higher. Should we expect contaminant breakthrough of the trench if wells immediately upgradient of the trench reach twice the levels listed in Table 1? Are the upgradient contamination concentrations, which are high enough to cause contaminant breakthrough of the trench, not expected to reach the wall?

**Parsons ES's Response:** While some long-term increases may be observed, there is little evidence to suggest that the concentration in the area of the trench would significantly increase. Quarterly groundwater monitoring in this area has not determined a consistent significant increase in VOC concentrations over the years that monitoring has occurred. For example, the data for PT-24, located downgradient of the trench along the fenceline, has been monitored since January, 1990. The concentration of TCE in December, 1992 was 6.7 ug/L, whereas the concentration of TCE in September, 1998 was 5 ug/L. The concentration of total DCE in December, 1992 was 110 ug/L, whereas the concentration of total DCE in September, 1998 was 96 ug/L. Groundwater modeling, performed by Parsons ES in 1996, suggested that following elimination of the source material, the concentration of VOCs at the fenceline should not increase beyond the variability of the existing database, assuming an overall degradation rate of 0.033 per year.

Elimination of the source of groundwater contamination in 1996 has resulted in notable reductions of VOC concentrations in groundwater at the source of approximately two orders of magnitude, from approximately 130,000 ug/L to 1,000 ug/L. Since the new source concentrations of 1000 ug/L is over 1500 feet away from the location of the reactive barrier wall, the time of travel for TCE to reach the trench is approximately 40 years. During that time of travel, reductions in concentration due to various geochemical factors such as dispersion, attenuation, volatilization and degradation are expected to occur. Since the current concentrations at the reactive barrier wall traveled from the same source through the same aquifer, it is reasonable to expect some future reductions at the location of the reactive wall. Thus, since the source has been reduced, to the point that the current source concentrations are only 1,000 ug/L and some reductions will be likely realized due to geochemical factors the future concentrations at the trench will be less than 1,000 ug/L.

The design considered the actual known concentrations of VOCs in the vicinity of the where the trench was to be placed, since the study was intended to be of a one-year duration. The integration of the reactive barrier wall into a final remedial action has yet to be determined. If this study is successful, the existing trench may serve as the final barrier to off-site migration and may be combined with one or two additional trenches to prevent higher concentrations from adversely affecting the reactive material. The life expectancy of the reactive material is considered to be approximately 10 years. Since no other reactive barrier wall application has reached the 10 year plateau of operation it is hard to determine with certainty what the life expectancy of the reactive material will be. Suffice to say that the trench material has a finite lifespan and therefore the reactive material will eventually require replacement. If the movement of TCE from the source area to the trench is 40 years, then trench material will have to have been potentially replaced 4 times. If projections show increases of VOC concentrations to levels above what the reactive material can destroy, then additional iron can be placed into the trench during the replacement to account for the increases of VOCs in the groundwater.

Finally, factors of safety were applied that will be able to account for various factors, such as concentration increases, that could affect the effectiveness of the reactive wall material. ETI, using their reaction kinetic model and experience, determined a residence of 1.25 days would be required, based upon existing groundwater concentrations. Using a groundwater velocity of 40 ft/yr, (0.11 ft./day), the minimum required trench width to yield this retention time, if the trench was completely filled with reactive iron, would be 0.14 feet. The installation technique involved the use of a continuous trencher that was limited to a minimum 14 inch trench thickness. To avoid unnecessary reactive iron costs, the design trench width, which was achieved during installation, utilized a 50/50 mixture of iron to sand. It is possible to calculate a reactive iron Safety Factor (SF) which would be the ratio of the actual amount of reactive iron to the required amount of iron. Expressed mathematically the SF would be: (0.5 X 1.2 feet)/0.14feet = 4.3. Considering a groundwater velocity of 60 ft/yr (0.17 ft/day), the SF would be: (0.5 x 1.2 feet)/0.21feet = 2.9. Therefore, sufficient amounts of reactive iron above what is required was placed in the trench to account for fluctuations in either groundwater concentrations or groundwater velocity.

**ETI's Response:** The residence time used in the design is based on VOC concentrations upgradient of the PRB. The highest concentrations, and thus the longest residence time, assumed were from well PT17 (TCE = 260 ug/L, cDCE = 53 ug/L and VC = 14 ug/L). Using these VOC concentrations a residence time of 30 hr was determined for 100% iron to reduce the VOCs to below 5,5, and 2 ug/L for TCE, cDCE, and VC, respectively (Figure 1). It is our understanding that the highest VOC concentrations observed at the site are more likely around 1,000 ug/L. Figure 2 shows that a residence time of 55 hours would be required to degrade 1000 ug/L of each of TCE, cDCE, and VC.

Based on about 50% iron by volume and a flow through thickness of 14 inches the effective thickness of 100% iron is 7 inches. Assuming an average linear groundwater velocity of -.11 ft/day, this thickness would give a residence time required for VOC concentrations upgradient of the system and over 2 times greater than that required to treat VOC concentrations of 1000 ug/L. Thus, the treatment system, as designed, has the capacity to degrade higher VOC concentrations than those immediately upgradient.

**Section 5.0:** Although the document states that the monitoring plan was based upon the referenced ITRC document, the monitoring does not seem adequate and does not agree with our copy of the ITRC document. Enclosed is Table 6-1, Permeable Barrier Monitoring Frequency, from the ITRC's December 1977 Regulatory Guidance for Permeable Barrier Monitoring Frequency, from the ITRC's December 1997 Regulatory Guidance for Permeable Barrier Walls Designed to Remediate Chlorinated Solvents. We request that the parameters and frequencies listed be adhered to for this project unless modifications are adequately rationalized. There is no piezometeric monitoring of the groundwater proposed. The work plan should be revised to include a groundwater level monitoring program per the guidance in the above document.

**Parsons ES's Response:** The ITRC document was considered as a guide for establishing a project specific monitoring plan. Parsons ES, in consultation with ETI, considered groundwater movement and flushing of residual soil water as factors that would tend to limit the expected changes to groundwater concentrations in the months shortly after the installation. The average velocity of groundwater has been estimated to be between 60ft/year (5ft/mo) and 40 ft/year (3.3 feet/month), depending upon the effective porosity value that is assumed. We consider 40 ft/year to be a reasonable value for this calculation. Assuming a retardation factor for TCE of 1.5, the retarded velocity of TCE in the aquifer is approximately 2.2 feet/month. The total travel distance will also include the width of the trench, making the distance 11.2 feet. Initially, Parsons ES had proposed to place monitoring wells at a location five feet upgradient and five feet downgradient of the barrier wall requiring approximately 5 months for groundwater to move from the upgradient point to the downgradient point. However, to observe the changes in as short a timeframe as possible, we propose to place the upgradient and downgradient monitoring wells 2.5 feet from the boundary of the trench. If, as we expect, the upgradient influent concentrations will remain constant over the monitoring period, the time necessary to observe a change in downgradient concentration will be approximately 2.8 months, i.e. 6.2 feet/ 2.2 feet/month. Initial monitoring of the wells more frequently will not be expected to yield changes due to the slow movement of groundwater. Expected decreases in concentration at the downgradient monitoring points will be further lessened as the barrier wall effluent water is mixed with the residual aquifer groundwater that would be similar to the upgradient concentrations. Changes in concentration may also be affected as the water table fluctuates, due to the infiltration of uncontaminated precipitation. This will reduce both the concentrations at the upgradient and downgradient locations. For these reasons, three sampling events are proposed during the first year after trench installation. The timing of these events has been modified slightly from what was originally proposed to space these sampling events out evenly. Sampling will be performed initially after installation of the wells, four months after installation and nine months after installation.

**ETI's Response:** An in-situ iron PRB is passive once installed. Since there are no moving parts or energy requirements a catastrophic failure is highly unlikely. More likely a failure would occur as a gradual change over time. Thus, monitoring frequencies should be designed based on site and technology specific parameters. A change in VOC concentration and inorganic parameters can be expected at the downgradient interface following installation. However, due to desorption of VOCs, diffusion of constituents out of low permeability zones and the buffering capacity of the aquifer, these changes are more gradual the further downgradient of the PRB the monitoring well is placed. Given a flow velocity of 0.2 ft/day and assuming the downgradient monitoring wells are located about 5 ft downgradient for the PRB, one sampling event after two months might provide some early indication, however, quarterly and semi-annually monitoring are likely sufficient. It is important to remember that for these early sampling events, VOC concentrations in the downgradient wells could likely be above regulatory criteria due to desorption of VOCs from aquifer sediments and migration out of low permeability zones.

**Section 5.1:** The work plan should detail action to be taken if contamination is found during the monitoring of side-gradient wells MW-T7 or MW-T8. We anticipate discovering bypassing contamination would require a design modification and/or a re-mobilization to extend the wall.

**Parsons ES's Response:** This effort is a treatability study to determine the effectiveness of the system, future additions or modifications to the system may be required. Since the type of modifications will depend upon the problem to be addressed it is premature and beyond the scope of the workplan to speculate on what the modification would be. However, the goal of the final action will be to completely capture the entire plume. This may include extension of the reactive wall if it is determined that additional contamination is not captured by the wall.

**ETI's Response:** In the event contamination is detected side-gradient of the PRB the source of contamination should be investigated. If the PRB is diverting flow around the ends of the system then measures to increase the permeability of the PEB maybe required. This could include scarification of the PRB using augers to break-up any crusting/cementation caused by precipitation/oxidation. If the PRB is not diverting flow around the system, then extending the PRB may be required.

**Section 6.0:** Soil removed from the trench should be assumed to be contaminated unless proven otherwise. The soil should be placed upon an impermeable surface and covered with a tarp; any water leaving the soil should be considered contaminated. Analysis of the soil should be for TAL/TCL. "Totals" analysis, not just TCLP, for proper future handling determinations.

**Parsons ES's Response:** Agreed. The soil which was excavated from the trench during construction was stockpiled near the Ash Landfill incinerator and covered with a tarp. Two soil samples were collected from the excavated soil and sent for VOC analysis. One soil sample will be collected from the soil which will be used for backfill and analyzed with a 24-hour turnaround time. The trench will not be backfilled until the results of the analyses are received from the laboratory.

**Appendix B, Section 02221:** References are made to a water line which intersects the trench. All efforts should be made to prevent the bedding of this pipeline to be a preferential pathway for groundwater moving both into and out of the trench. Either of these cases will cause more rapid localized water flow leading to decreased residence times and a higher potential for contaminant breakthrough. As the figures show this water line to terminate a short distance past the proposed trench location, consideration should be given as to whether this line should be abandoned and/or removed so that its potential to compromise this remedial effort is eliminated.

**Response:** Agreed. If the water line had been encountered during the construction of the trench, a bentonite seal would have been packed around the section of the water line that crosses the trench. However, the water line was not encountered and this was never an issue.

**Appendix B, Figure 6:** As the design calls for a continuous reactive wall treatment trench, this figure is mislabeled "Cross Section, Funnel System", and Figure 7 is mislabeled as "Reactive Gate".

**Response:** Agreed. Figures 6 and 7 are mislabeled.

**References:**

Gavaskar, A.R., Gupta, N., Sass, B.M., Janosy, R.J. and O'Sullivan D., 1998, Permeable Barriers for Groundwater Remediation. Battelle Press, Columbus, Ohio, pp. 38-39.

Garon, K. P., B.S. Schultz and R.C. Landis, 1998. Modeling of Plume Capture by Continuous, Low-Permeability Barriers. Ground Water Monitoring Review. Summer 1998, pp. 82-87.

Interstate Technology and Regulatory Cooperation (ITRC) Work Group, Permeable Barrier Walls Work Team Regulatory Guidance Project, 1997. Regulatory Guidance for Permeable Barrier Walls design to Remediate Chlorinated Solvents.

Odziemkowski, M.S., and R.W. Gillham 1997. Surface Redox Reactions on Commercial Grade Granular Iron (Steel) and Their Influence on the Reductive Dechlorination of Solvent - Micro Raman Spectroscopic Studies. Extended Abstracts from the 213th ACS National Meeting, Division of Environmental Chemistry, San Francisco, CA, April 13-17 1997, Vol. 37, No 1, pp. 177-160.

Vogan, J.L., B.G. Butler, M.K. Odziemkowski, G. Friday and R.W. Gillham, 1998. Laboratory Evaluation of Cores from Permeable Reactive Barriers. Proceedings from the First International Conference on Remediation of Chlorinated and Recalcitrant Compounds, Monterey, California, May 18-21, Battelle Press, Columbus, Ohio, Vol. C1-6, pp. 163-168.

United States Environmental Protection Agency, 1997. EnviroMetal Technologies Inc. Metal-Enhanced Dechlorination of Volatile Organic Compounds Using an Aboveground Reactor. Innovative Technology Evaluation Report. June, EPA/540/R-96/503, p.16.

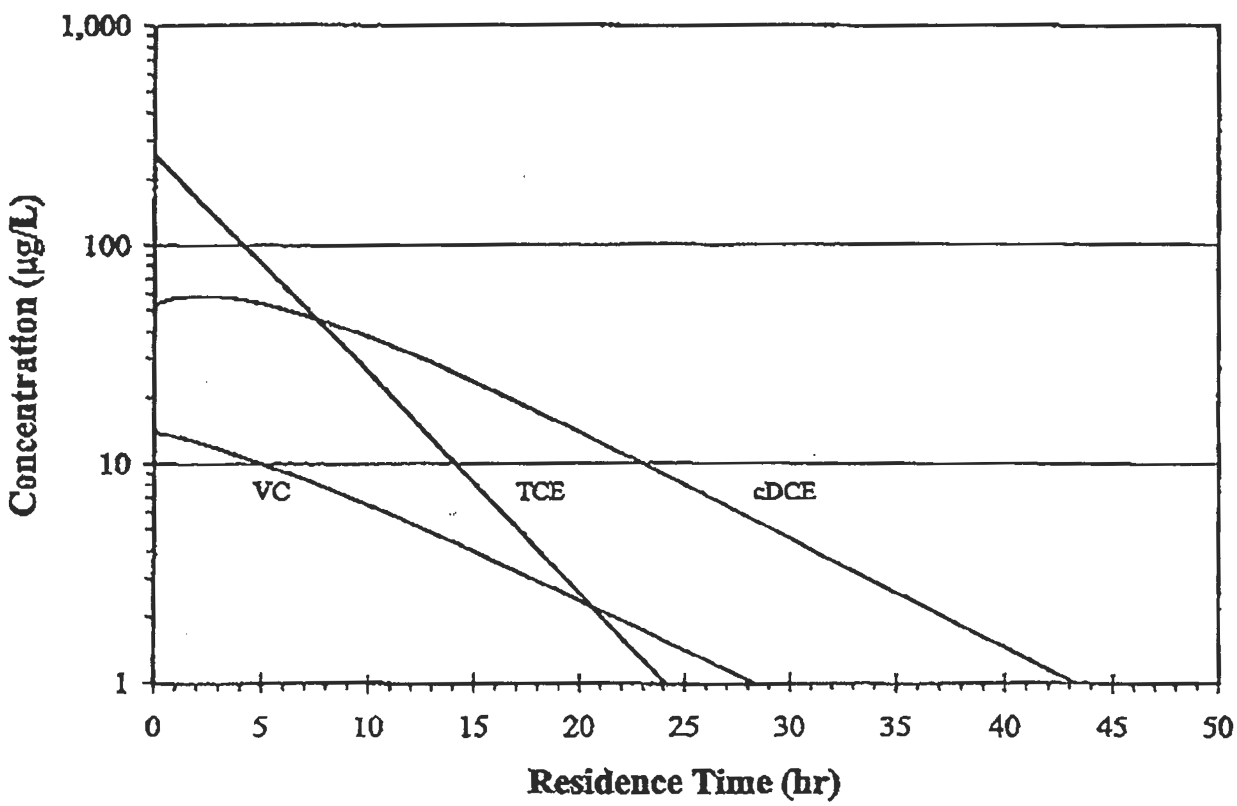



Figure 1: EnviroMetal process degradation model results. ($TCE_o$ = 260 µg/L, $cDCE_o$ = 53 µg/L and $VC_o$ = 14 µg/L).

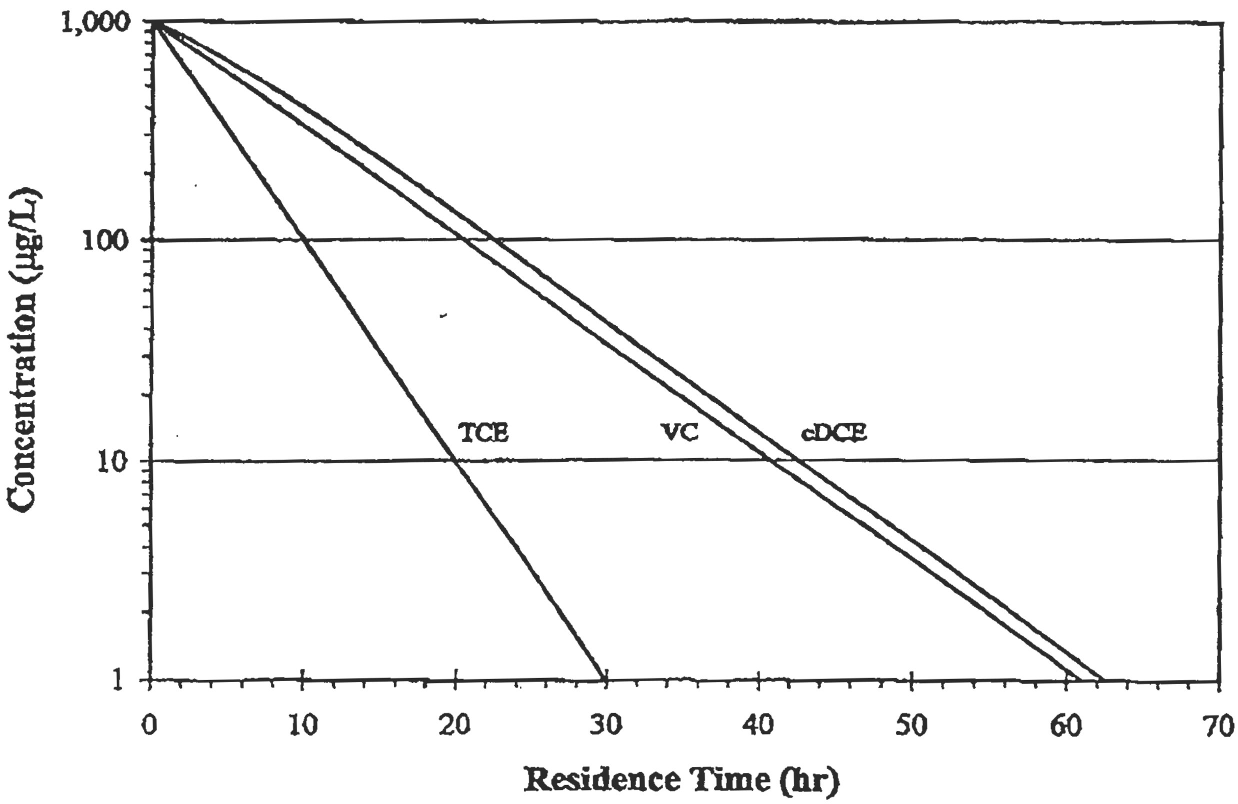



Figure 2: EnviroMetal process degradation model results. ($TCE_o$ = 1,000 µg/L, $cDCE_o$ = 1,000 µg/L and $VC_o$ = 1,000 µg/L).

**Response to the EPA Comments on the Treatability Study Work Plan for Zero Valence Iron Continuous Reactive Wall at the Ash Landfill**
**Comments dated January 22, 1999**

**General Comments:** The technical specifications presented in the appendix do not match the method of installation for the trench presented in the text of the Work Plan. Parsons Engineering Science, Inc. stated that the specifications have been changed to reflect the method of installation in the field. The new specifications have not been submitted.

**Response:** The technical specifications which were distributed for bidding purposes incorporated methods for installation of the trench using conventional excavation equipment, since bids initially were solicited from contractors having conventional excavation equipment. Since a contractor having continuous trenching equipment was finally selected, Technical Specification 02221 (Excavation and Filling) had been tailored for the use of this equipment. The modified specification has been substituted in Appendix D.

**Specific Comments**

**Page 4, Section 2.3:** The text in this section states that MW-44 is located in the source area, however, a review of Figure 1 shows that there is no MW-44 in the plume, but there is a MW-44A. Text should be added to the document explaining which well is being discussed. The text in this paragraph also states that VOCs range from 10 ug/L to 100 ug/L; however, a review of Figure 1 shows a maximum concentration of 157 ug/L. The text should be corrected to reflect this maximum concentration.

**Response:** Agreed. MW-44 was located in the source area before the removal action took place at the Ash Landfill. The concentrations referenced in this section from MW-44 were detected prior to the removal action. Since MW-44 was located in the source area which was removed, MW-44 was removed and later replaced with MW-44A in the same location. The text has been modified to clarify that MW-44, the monitoring well from which the referenced data were collected, was located where MW-44A currently exists in Figure 1.

The text has been revised to state that VOCs range from 10 ug/L to 200 ug/L so that the concentration detected at MW-29 is incorporated in this range of values.

**Page 5, Section 3.0, p1:** The text references a groundwater model completed as part of the treatability study, this model should be presented in this document so the reader may review the appropriateness of the selected configuration of the reactive wall.

**Response:** The groundwater modeling study has been presented in Appendix C. This study found that both a funnel and gate system using four gates and a continuous wall system would be effective in capturing the contaminant plume without unreasonable upgradient mounding effects. The continuous wall system was selected for the following reasons: 1) a continuous wall system raises no hydraulic concerns with respect to groundwater mounding. Although the degree of mounding for the funnel and four gate system was shown to be reasonable in the modeling study, some mounding would occur. 2) Recent studies discussed in our response to NYSDEC's General Comment #1 showed that there are negligible effects on the reactivity of the reactive iron when subjected to unsaturated conditions. Therefore, the increased liklihood of unsaturated conditions in a continuous wall system may not impact the performance of the system; and 3) the continuous system is more cost effective to install.

**Page 7, Section 5.1, p2:** The purpose of MW-T8, i.e., to monitor for migration of contamination around the reactive wall, will be compromised because the well is located within the plume which is shown on Figure 1. Based on this, the wall should be extended further to the south, and should extend to a point almost directly west of monitoring well MW-30.

**Response:** The plume contour lines on Figure 1 may not accurately reflect the southern extent of the plume due to the presence of West Smith Farm Road. Contour lines indicate estimated concentrations based on the groundwater monitoring data shown and do not take into account the physical barrier that West Smith Farm Road may be providing as well as the topographic high point of competent shale which was observed to occur near this road during construction (based on trench bottom topography - see Figure G-1 attached). As we discussed during our conference call on December 8, 1998, except for MW-30, there is no evidence that the plume has migrated across this road. As USEPA pointed out, there have been occasional detections of TCE in MW-30 at concentrations hovering above the detection limit and below NYSDEC GA Standards. These detections have not been consistent. Because we are not convinced that the plume extends across the road, it was decided not to extend the wall across this road. Monitoring well MW-T11 (previously called MW-T8 in the earlier version of the treatability study work plan) will be located in the road at the southern end of the trench. If chlorinated solvents are detected in this well, the final remedy at the site will need to address this extension of the plume. However, for the purposes of this treatability study, monitoring from this well will occur before further action is taken.

**Page 7, Section 5.2.2:** The method of well installation within the reactive wall should be changed from the methods presented in the Generic Plan. The suggested method of well installation in direct push or drive casing, these methods will minimize the disturbance to the reactive materials during well installation.

**Response:** Agree. The text has been changed to reflect that the three groundwater monitoring points to be installed within the trench by direct push methods. The SOP for installation and sampling of these monitoring points is provided in Appendix G.

**Page 7, Section 5.3.1, p1:** The text in this section states that sampling will be conducted in June and December 1999; however, a review of Table 2 shows that the sampling will be conducted in March and December, this discrepancy should be corrected.

**Response:** Agreed. Samples for indicator parameters will be collected in March, June and December 1999. Both the text and Table 2 has been corrected to reflect this.

**Page 8, Section 5.3.2, p1**: The text implies that field parameters will only be recorded after stabilization has occurred, the text should be corrected to state that readings will be recorded more frequently to document stabilization of the field parameters.

**Response:** Agreed. The text has been changed to reflect that field parameters will be recorded periodically to document stabilization of field parameters.

**Page 8, Section 6.0:** Additional detail should be presented in this section as to the length of time the materials will be stored prior to disposal.

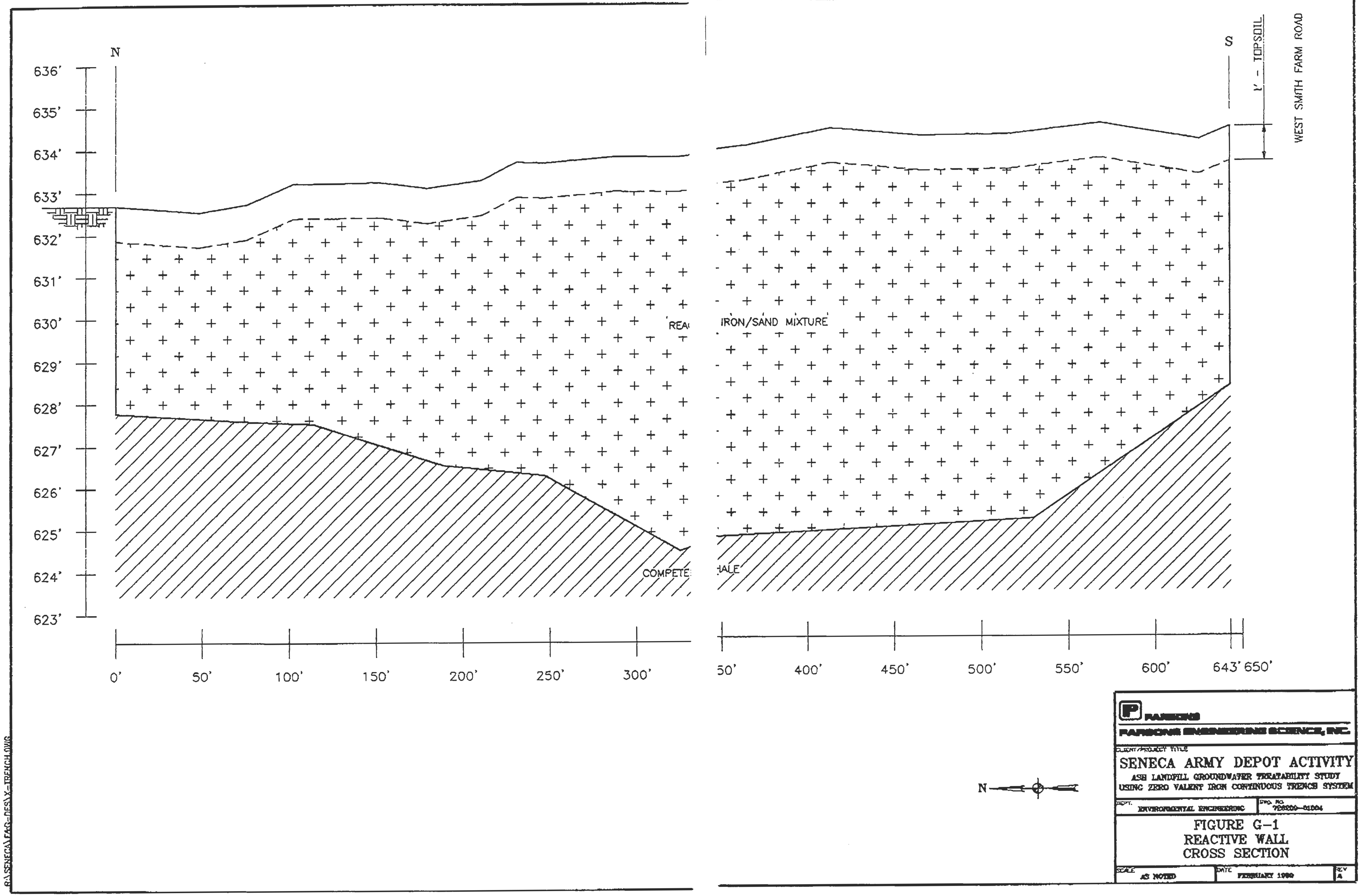
**Response:** Agreed. The text has been changed to reflect the following. Soil from the excavation has been stockpiled at the Abandoned Incinerator Building. The soil was tested for total VOCs at a frequency of every 100 CY, rather than for TCLP VOCs every 200 CY, as previously noted in the text. Soil results indicated that the highest concentration of TCE was 160 ug/kg, well below the TAGM of 700 ug/kg. Soil from this stockpile may be considered by SEDA as fill at other sites at SEDA. This soil will remain at the Abandoned Incinerator Building until used elsewhere on the site. The contractor was responsible for their own PPE. Decon water will be tested and disposed by SEDA in a timely manner.

**Figure 1:** The reactive wall presented in this figure does not extend through the width of the plume, the wall should be extended to the south to capture and treat the plume.

**Response:** Please refer to the response to your comment on Page 7, Section 5.1, p2 above.

**Table 2:** The inorganic parameters should be collected and analyzed every quarter of sampling. Additional sampling, beyond the one year of sampling presented in the work plan, should be conducted to show that the downgradient monitoring wells are showing reducing concentrations.

**Response:** The inorganic parameters will be collected during each of the three sampling events proposed (initially after well installation, four months after installation, and nine months after installation). The need for additional sampling will be assessed once the first year of monitoring is completed and evaluated. This assessment will be made in the treatability study report to be issued after the first year of data have been collected.


N
S
1' - TOPSOIL
WEST SMITH FARM ROAD
636'
635'
634'
633'
632'
631'
630'
629'
628'
627'
626'
625'
624'
623'
REA
IRON/SAND MIXTURE
COMPETE
HALE
0'
50'
100'
150'
200'
250'
300'
50'
400'
450'
500'
550'
600'
643'
650'
N
PARSONS
PARSONS ENGINEERING SCIENCE, INC.
SENECA ARMY DEPOT ACTIVITY
ASH LANDFILL GROUNDWATER TREATABILITY STUDY
USING ZERO VALENT IRON CONTINUOUS TRENCH SYSTEM
ENVIRONMENTAL ENGINEERING
FIGURE G-1
REACTIVE WALL
CROSS SECTION
AS NOTED
FEBRUARY 1999
A