9/5037

RI/FS REPORT FOR

# NY STATE SUPERFUND STANDBY CONTRACT
# HOUDAILLE-MANZEL SITE
# City of Buffalo, Erie County

**WORK ASSIGNMENT NO. D002478-2**
**SITE NO. 9-15-037**

PREPARED FOR

VOL. III APPENDICES F-L



**New York State**
**Department of**
**Environmental Conservation**
**Albany, New York**

50 Wolf Road, Albany, New York 12233
Thomas C. Jorling, Commissioner

**Division of Hazardous Waste Remediation**
Michael J. O'Toole, P.E., Director

PREPARED BY

ES
ENGINEERING-SCIENCE
Liverpool, New York

NOVEMBER 1991
SY117.06

# APPENDIX F

# DATA VALIDATION REPORT

# APPENDIX F.1

# DATA VALIDATION - FIRST ROUND

**ES**
**ENGINEERING-SCIENCE, INC.**

30800 TELEGRAPH ROAD
SUITE 6858
BIRMINGHAM, MICHIGAN 48010
Tel: (313) 433-2700 FAX: (313) 433-0835

# Letter of Transmittal

To: ES/Syracuse
209 Elwood Davis Rd Suite 312
Liverpool, NY 13088

Attn: Pete Petrone

Date: 1-10-91
File No. SY117.02
Subject: Data Validation of Houdaille Manzel

We are sending you X Enclosed ___ Under Seperate Cover

the following item:

1. Data Validation Report
2. Data Validation notes
3. Flagged Summary Tables.

These are transmitted as checked below:

___ For Your Information
___ As Requested
X For Your Use
___ For Approval
___ Approved as Noted
___ For Review

Remarks:

Copy To:

Signed: Janet Hall

## SUMMARY OF THE HOUDIALLE - MANZEL SITE SAMPLE ANALYSES

| | VOC | BNA | PCB | HSL METALS | Cu and Pb | EPTOX (METALS) | $CN^-$ |
|---|---|---|---|---|---|---|---|
| **SDG 50 (SOIL)** | | | | | | | |
| HOMA-SO-1 | | | X | | | | X |
| HOMA-SO-1MD | | | | | | | X |
| HOMA-SO-1MS | | | X | | | | X |
| HOMA-SO-1MSD | | | X | | | | |
| HOMA-SO-2 | | | X | | | | X |
| HOMA-SO-3 | | | X | | | | X |
| HOMA-SO-4 | | | X | | | | X |
| HOMA-SO-5 | | | X | | | | X |
| HOMA-SO-6 | | | X | | | | X |
| HOMA-SO-7 | | | X | | | | X |
| HOMA-SO-8 | | | X | | | | X |
| HOMA-SO-9 | | | X | | | | X |
| HOMA-SO-10 | | | X | | | | X |
| HOMA-SO-11 | | | X | | | | X |
| HOMA-SO-12 | | | X | | | | X |
| HOMA-SO-13 | | | X | | | | X |
| HOMA-SO-14 | | | X | | | | X |
| HOMA-SO-15 | | | X | | | | X |
| **SDG 51 (SOIL)** | | | | | | | |
| HOMA-SO-2 | | | | | X | | |
| HOMA-SO-2MD | | | | | X | | |
| HOMA-SO-2MS | | | | | X | | |
| HOMA-SO-3 | | | | | X | | |
| HOMA-SO-4 | | | | | X | | |
| HOMA-SO-5 | | | | | X | | |
| HOMA-SO-6 | | | | | X | | |
| HOMA-SO-7 | | | | | X | | |
| HOMA-SO-10 | | | | | X | | |
| HOMA-SO-11 | | | | | X | | |
| HOMA-SO-12 | | | | | X | | |
| HOMA-SO-15 | | | | | X | | |
| HOMA-SO-20 | | | | | X | | |
| HOMA-SO-23 | | | | | X | | |
| HOMA-SO-24 | | | | | X | | |
| HOMA-SO-25 | | | | | X | | |
| HOMA-SO-30 | | | | | X | | |

## SUMMARY OF THE HOUDIALLE - MANZEL SITE SAMPLE ANALYSES (continued)

| | VOC | BNA | PCB | HSL METALS | Cu and Pb | EPTOX (METALS) | $CN^-$ |
|---|---|---|---|---|---|---|---|
| **SDG 53 (SOIL) (continued)** | | | | | | | |
| HOMA-SO-60 | | | X | | X | | |
| HOMA-SO-61 | X | X | X | X | | X | |
| HOMA-SO-62 | X | X | X | X | | | |
| HOMA-SO-63 | | | X | | X | | |
| HOMA-SO-64 | | | | | X | | |
| HOMA-SO-65 | X | | | | | | |
| HOMA-SO-66 | | | | | X | | |
| HOMA-SO-67 | | | X | | X | | |
| HOMA-SO-68 | | | | | X | | |
| HOMA-SO-69 | | | X | | X | | |
| HOMA-SO-70 | | | | | X | X | |
| HOMA-SO-70MD | | | | | X | | |
| HOMA-SO-70MS | | | | | X | | |
| **SDG 54 (SOIL)** | | | | | | | |
| HOMA-SO-71 | | | | | X | | |
| HOMA-SO-72 | X | | X | | X | | |
| HOMA-SO-72MD | | | | | X | | |
| HOMA-SO-72MS | X | | X | | X | | |
| HOMA-SO-72MSD | X | | X | | | | |
| HOMA-SO-73 | X | | X | | X | | |
| HOMA-SO-74 | | | | | X | | |
| HOMA-SO-75 | X | | | | | | |
| HOMA-SO-76 | X | | | | | | |
| HOMA-SO-77 | X | | | | | | |
| HOMA-SO-78 | X | | | | | | |
| **SDG 55 (AQUEOUS)** | | | | | | | |
| HOMA-MW-1 | X | X | X | X | | | |
| HOMA-MW-1MD | | | | X | | | |
| HOMA-MW-1MS | X | X | X | X | | | |
| HOMA-MW-1MSD | X | X | X | | | | |
| HOMA-MW-2 | X | X | X | X | | | |
| HOMA-MW-3 | X | | X | | X | | |
| HOMA-MW-4 | X | | X | | X | | |
| HOMA-MW-5 | X | X | X | X | | | |
| WASH BLANK | X | X | X | X | | | |
| TRIP BLANK1 | X | | | | | | |
| TRIP BLANK2 | X | | | | | | |

# DATA VALIDATION OF

# VOLATILE ORGANIC COMPOUNDS

This report contains the validation of samples in SDG 52, 53, 54, and 55.

## I. HOLDING TIMES

All samples were analyzed within 7 days from VTSR. The signature for receipt of the samples by the laboratory is not always in the proper section of the COC. The laboratory representative should always sign for receipt of the samples in the designated box.

## II. GC/MS TUNE

GC/MS Tune (BFB) requirements were met in all cases.

## III. CALIBRATIONS

**Initial calibrations** were performed at the required 5 concentrations for each instrument used for analysis. The following SDG had an analyte with a RSD in the initial curve greater than 30%.

| SDG | ANALYTE | RSD |
|---|---|---|
| 54 | 2-butanone | 30.4 |

All 2 butanone values in associated samples within SDG 54 are flagged with a "J" for estimated due to the RSD >30% for the initial calibration.

**Continuing calibration** verifications were performed at the beginning of each 12 hour run batch. The percent difference (%D) from the initial calibrations were less than 25% in all cases except the following.

| SDG | ANALYTE | %D |
|---|---|---|
| 52 | acetone | -25.2 |
| | bromomethane | -28.9 |

**Method blanks** were analyzed with each analytical batch to determine the possible contamination during method preparation and analysis. The results were reported on Form IV. Most were found to be have acetone and toluene at concentrations below the CRDL. All the associated sample values have been flagged with a "B" for blank contamination. Acetone was also found at concentrations above the CRDL and seems to be a contaminate of the dilution water. All associated acetone and toluene values are flagged with a "U" if greater than the CRDL and less than 10 times the blank concentration.

## V. SURROGATE AND INTERNAL STANDARD RECOVERY

All samples and blanks were spiked with surrogates and internal standards and the results reported on the appropriate Forms. Some surrogate recoveries were low or not calculated due to sample dilutions. Blanks, and undiluted samples had acceptable surrogate recoveries and internal standard recoveries with the exception of the following:

| SDG | Samples | Surrogates | Internal Stds |
|---|---|---|---|
| 52 | 31,35,36,37,40 | TOL | |
| | 33,35,36,40,48 | BFB | |
| | 40 | | BCM |
| | 31,32,40 | | DFB |
| | 31,32,33,35,36,37,44 | | CBZ |
| 53 | 57,61,62,65 | TOL | |
| | 65 | BFB | |
| | 57 | | CBZ |
| 54 | 77,78 | TOL | |
| | 76,77,78 | BFB | |
| | 77,78 | | CBZ |

All associated analytes in the above samples are flagged with a "J" if results are greater than the IDL, and "UJ" for results less than the IDL.

## VI. MATRIX SPIKE/MATRIX SPIKE DUPLICATES (MS/MSD) and BLANK SPIKE (BS)

Each SDG had MS/MSD and BS analyses. All analyses are acceptable or contained a minor problem. SDG 55 had low recovery of toluene in both the MS and MSD. Toluene in the associated samples is already flagged for other deviations from QC limits.

## X. OVERALL ASSESSMENT OF DATA FOR THE CASE

The quality assurance objectives for measurement data include considerations for precision, accuracy, completeness, representativeness and comparability. The data package as presented by RECRA Environmental, Inc. is 100% complete and meets the requirements of the QAPP, and is acceptable for the intended use of analytical results.

**Method blanks** were analyzed with each matrix extraction batch to determine the possible contamination during method preparation and analysis. The results were reported on a Form IV. Blanks for SDG 62 and 63 were free of contamination. One blank (SBLK05) in SDG 52 was found to be have a TIC at 7.03 mins. that was also found in sample number 31. This TIC in sample 31 is not to be considered as an environmental contaminate.

## V. SURROGATE and INTERNAL STANDARD RECOVERY

All samples and blanks were spiked with surrogates and internal standards, and the results reported on the appropriate Forms. Some surrogate recoveries were low or not calculated due to sample dilutions. Blanks, and undiluted samples had acceptable surrogate recoveries with the exception of:

SDG 52 sample 44 DL and SBLK18 had more than one surrogate out and all positive results are flagged as estimated with a "J", and all negative results are flagged as estimated with a "UJ".

SDG 53 sample 57 and SBLK06 had one surrogate out, and the associated positive results are flagged as estimated with a "J", and the associated negative results are flagged as estimated with a "UJ".

SDG 55 samples MW5, MW5-RE, MW1 MS, MW1 MSD, MW1 MS RE, and MW1 MSD RE had low acid surrogate recoveries. All associated positive acid results are flagged as estimated with a "J", and the associated negative acid results are flagged as estimated with a "UJ".

SDG 52 had non compliant internal standard areas for perylene in the MSBLK, MSBLK RE, and SBLK18. No additonal flags were required.

## VI. MATRIX SPIKE/MATRIX SPIKE DUPLICATES (MS/MSD) and BLANK SPIKE (BS)

Each SDG had MS/MSD and BS analyses. All analyses are acceptable or contained some minor problems.

SDG 52 MSBLK and MSBLK RE had high recoveries of 4-nitrophenol and pentachlorophenol. Sample 33 MS and MSD both had very low recoveries of

## X. OVERALL ASSESSMENT OF DATA FOR THE CASE

The quality assurance objectives for measurement data include considerations for precision, accuracy, completeness, representativeness and comparability. The data package as presented by RECRA Environmental, Inc. is 100% complete and meets the requirements of the QAPP, and is acceptable for the intended use of analytical results.

## V. MATRIX SPIKE/MATRIX SPIKE DUPLICATES (MS/MSD) and BLANK SPIKE (BS)

MS/MSD analyses were performed on a sample in each SDG. The MS/MSD analyses were acceptable with the following exceptions:

Due to a matrix interference at the choosen arochlor 1260 quantitation peak for sample 1 and 1 MS/MSD in SDG 50, a different quantitation peak was choosen. At this time an error was made in calculation of the arochlor 1260 value for the MSD, the value of 560 should be 460. Mary Thompson of RECRA was contacted and verified the error. Form I pg 0255 and Form III pages 0043 and 0059 were corrected. The percent recovery is now 51, and the RPD is now 16%.

Sample 33 and the 33 MS/MSD of SDG 52 were diluted out. The MS Blank was acceptable and no additional flags were necessary.

All the MSB recoveries were acceptable.

## VI. DUPLICATES

No duplicate analyses were performed.

## VII. TARGET COMPOUND IDENTIFICATION

The retention time shifts of DBC as reported on the summary Form VIII were compliant with the exception of some of the samples in which the DBC had been diluted out, and the secondary column shifts in SDG 52 as previously discussed in section IV. The retention times of PCB quantitation peaks were within appropriate windows for all samples.

## VIII. COMPOUND QUANTITATION AND REPORTED DETECTION LIMITS

All positives were calculated accounting for the dry weights and dilutions where appropriate, and results transcribed correctly on Form I.

Detection limits were acceptable with the exception of samples 33, and 33 MS/MSD in SDG 52. Interferences on the early part of the chromatogram required a dilution of 1:10, thus, no surrogate or spike recoveries were calculated. The rise in the baseline at 1 to 7 min. RT due to the interference

# DATA VALIDATION OF

# HSL METALS, COPPER AND LEAD, EPTOX (METALS), AND CYANIDE

This report contains the validation of samples in SDG 50, 51, 52, 53, 54, and 55.

## I. HOLDING TIMES

Sample preparation dates as presented by RECRA Environmental, Inc. indicate that all samples met holding time requirements, but some of the COCs do not contain the signature or date and time of sample receipt by the laboratory. This is a serious breach of protocol and the laboratory must prevent such occurances in the future.

## II. CALIBRATIONS

**Initial calibrations** were acceptable.

**Continuing calibration** were acceptable.

## III. BLANKS

**One wash blank**, SDG 55 Wash Blank was analyzed for the HSL metals and found to be free of contamination except for low concentrations of some metals that were flagged with a "B" for having a concentration greater than the IDL and less than the CRDL. No additional flags are required.

**Preparation blanks** were analyzed with each preparation batch and reported on a Form III. All were found to be free of significant contamination relative to the results of the sample analyses.

## IV. INTERFERENCE CHECK SAMPLES (ICS)

All ICS were acceptable.

and the spike recovery < 85% or > 115% the analytes with were flagged with a "W". If the sample concentration was > 50% of spike concentration, and the spike recovery < 85% or > 115% the analytes were quantitated by the method of standard addition (MSA). If the correlation coefficient of the MSA < 0.995 the analytes were flagged with a "+". If the correlation coefficient of the MSA ≥ 0.995 the analytes were flagged with a "S". The following are the conditions of any additional flags assigned by this reviewer for furnace metals:

| Flag | Sample Result | Assigned Flag |
|---|---|---|
| "E" | >IDL | "J" |
| "E" (%R >10, <40) | <IDL | "UJ" |
| "E" (%R <10) | <IDL | "R" |
| "W" | >IDL | "J" |
| "W" | <IDL | "UJ" |
| "+" | any | "J" |
| "S" | any | none |

## IX. ICP SERIAL DILUTIONS

For samples with a high analyte concentration (a factor of 50 above the IDL), serial dilution analysis is performed. If a 5-fold serial dilution was > 10% different from the original results the "E" flag was assigned to indicate interferences. The "E" flagged results for HSL Pb and Cd in SDG 52, and Al, Fe, Mn, Zn in SDG 53 were also assigned the "J" flag (for estimated) by this reviewer.

## X. SAMPLE RESULT VERIFICATION

Sample result verification was acceptable except for some of the Ca analyses in SDG 52. The raw data for the flame analyses of Ca on 10/03/90 was so poorly copied that it was not readable, thus, this reviewer can not comment upon the verification of the analytical results.

# APPENDIX F.2

# DATA VALIDATION - SECOND ROUND

**ES**
**ENGINEERING-SCIENCE**

30800 TELEGRAPH ROAD, SUITE 3858
BIRMINGHAM, MI 48010
313/433-2700 FAX 313/433-0838

**DATA VALIDATION FOR:**

**POLYCHLORINATED BIPHENYLS (PCB), HAZARDOUS SUBSTANCE LIST METALS (HSL), and LEAD (Pb)**

| | |
|---|---|
| **CLIENT:** | **ENGINEERING-SCIENCE/SYRACUSE** |
| **SITE:** | **HOUDIALLE - MANZEL SITE** |
| **PROJECT:** | **SY117.05** |
| **LABORATORY:** | **RECRA ENVIRONMENTAL, INC.** |
| **REVIEWER:** | **JANET HALL** |
| **FROM:** | **ENGINEERING-SCIENCE/DETROIT** **PHONE: (313)433 2709** |
| **DATE REVIEW COMPLETED:** | **JULY 8, 1991** |

The data package submitted by RECRA Environmental, Inc. consisted of SDGs 121 (10 soil samples), and SDG 122 (3 aqueous samples). All samples were shipped under a Chain of Custody (COC) and received by the laboratory intact. All samples met sampling protocols.

The data package was validated and reviewed for useability with respect to the requirements as stated in the Quality Assurance Project Plan, the NYSDEC Analytical Services Protocol (ASP), 9/89, the EPA SW846, and the EPA guidance published in "Laboratory Data Validation: Functional Guidelines for Evaluating Organics Analyses," February, 1988, and "Laboratory Data Validation: Functional Guidelines for Evaluating Inorganics Analyses," July, 1988.

This data validation and useability report is presented by type of analysis with each SDG addressed within each type. The samples contained within the SDGs and the analyses performed are presented in the summary table on the following page.

# DATA VALIDATION OF

# POLYCHLORINATED BIPHENYLS

This report contains the validation of samples in SDG 122.

## I. HOLDING TIMES

All samples were extracted within 5 days from VTSR for all samples.

## II. CALIBRATIONS

**Initial calibrations** were acceptable.

**Continuing calibration** verifications were acceptable.

## III. BLANKS

**A method blank** was analyzed with the extraction batch and reported on a modified Form IV. The method blank was found to be free of contamination.

## IV. SURROGATE RECOVERY

All samples and blanks were spiked with the appropriate amount of dibutylchlorendate (DBC) as a surrogate and the results reported on a modified Form II. All surrogate recoveries were acceptable.

## V. MATRIX SPIKE/MATRIX SPIKE DUPLICATES (MS/MSD) and BLANK SPIKE (BS)

Non MS/MSD analyses were performed for this SDG.

## VI. DUPLICATES

No duplicate analyses were performed.

# DATA VALIDATION OF

# HSL METALS AND LEAD

This report contains the validation of samples in SDGs 121 and 122.

## I. HOLDING TIMES

Sample preparation dates as presented by RECRA Environmental, Inc. indicate that all samples met holding time requirements.

## II. CALIBRATIONS

**Initial calibrations** were acceptable.

**Continuing calibration** were acceptable except the "autozeroing or rezeroing" after each sample during the AA analyses. Ms. Verl Preston of RECRA Environmental, Inc., has stated that the "autozeroing" indicated in the raw data and the "rezeroing" stated in the case narrative of SDG 121 are misnomers, the zero of the instrument is an integration correction feature programed into the Perkin-Elmer 3100, it is not a recalibration. Clarifying statements shall be faxed by Laboratory to ES Detroit and shall be included with this review.

## III. BLANKS

**Preparation blanks** were analyzed with each preparation batch and reported on a Form III. All were found to be free of significant contamination relative to the results of the sample analyses.

## IV. INTERFERENCE CHECK SAMPLES (ICS)

All ICS were acceptable.

## V. LABORATORY CONTROL SAMPLES (LCS)

All LCS results were within the CLP required 80 - 120 % recovery range.

## IX. ICP SERIAL DILUTIONS

For samples with a high analyte concentration (a factor of 50 above the IDL), serial dilution analysis is performed. If a 5-fold serial dilution was > 10% different from the original results the "E" flag was assigned to indicate interferences. The "E" flagged results for all HSL Ca, Fe, Mg, Mn, and Na in SDG 122 were also assigned the "J" flag (for estimated) by this reviewer.

## X. SAMPLE RESULT VERIFICATION

Sample result verification was acceptable except for the sample identifications for SDG 122 on the analysis run logs, pages 188, 191, and 195. The identifications of which samples were total or soluble is not consistent with the Form I results or the raw data. Ms. Verl Preston of RECRA Environmental, Inc. will fax the corrected pages and a statement clarifying the laboratory identification scheme.

## XI. COMPOUND QUANTITATION AND REPORTED DETECTION LIMITS

All positives were calculated accounting for the dry weights and dilutions where appropriate, and results transcribed correctly on Form I.

The Quarterly IDL reports for ICP, AA, and GFAA (Form X in SDG 122) were acceptable.

CRDL Standards (CRI and CRA) are run to verify linearity. The CRA recoveries were very low for Pb in SDG 121 (16.7%) and low for Pb, Se, and Ag in SDG 122 (66.7, 80.0 and 70.0% respectively). The CRA recovery was high for Tl in SDG 122 (130%). Since there are no advisory limits for the recoveries, and Pb results for SDG 121 are already determined to be estimated, this reviewer shall not assign additional flags to the results of SDG 122.

All sample results flagged with a "B" by the laboratory were from a reading higher than the IDL, but lower than the CRDL. The reviewer has also flagged these values with "J" for estimated value.

# DATA VALIDATION OF

# EPTOX LEAD

This report contains the validation of two samples, S-5 and S-7, from SDG121.

## I. HOLDING TIMES

All samples were extracted and analyzed within the required 6 months of VTSR.

## II. CALIBRATIONS

**Initial calibrations** of the Flame Atomic Absorption Unit was acceptable.

**Continuing calibration checks** were acceptable and were run at the required 10% frequency.

## III. BLANKS

The initial calibration blank and continuing calibration blanks were run at the required frequency, and were free from analyte contamination. The prep blank, PBW, was run at the required frequency and was free of analyte contamination.

## IV. INTERFERENCE CHECK SAMPLES (ICS)

This analysis was not done by ICP, therefore this section does not apply.

## V. LABORATORY CONTROL SAMPLES (LCS)

The LCS was run in the batch at required frequency and was shown to be within limits for % recovery.

## VI. MATRIX SPIKE

Each sample was spiked with three different quantities of Pb standard as a % recovery check. Each of these spike recoveries was within the quality control limits of 90-110% recovery.

1D
# PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.: HOMAMW1

Lab Name: RECRA ENVIRON    Contract: ____

Lab Code: RECNY    Case No.: 2602    SAS No.: ____    SDG No.: 122

Matrix: (soil/water) WATER    Lab Sample ID: SW5053

Sample wt/vol: 1000 (g/mL) ML    Lab File ID: ____

Level: (low/med) LOW    Date Received: 05/15/91

% Moisture: not dec. __    dec. __    Date Extracted: 05/20/91

Extraction: (SepF/Cont/Sonc) SEPF    Date Analyzed: 05/29/91

GPC Cleanup: (Y/N) N    pH: 7.0    Dilution Factor: 1.00

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L | Q |
|---|---|---|---|
| 12674-11-2 | Aroclor-1016 | 0.50 | U |
| 11104-28-2 | Aroclor-1221 | 0.50 | U |
| 11141-16-5 | Aroclor-1232 | 0.50 | U |
| 53469-21-9 | Aroclor-1242 | 0.50 | U |
| 12672-29-6 | Aroclor-1248 | 0.50 | U |
| 11097-69-1 | Aroclor-1254 | 1.0 | U |
| 11096-82-5 | Aroclor-1260 | 1.0 | U |

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MW1

Lab Name: RECRA_ENVIRONMENTAL_INC._ Contract: Q90-322___

Lab Code: RECNY_ Case No.: 2602_ SAS No.: ______ SDG No.: 122___

Matrix (soil/water): WATER Lab Sample ID: 5898______

Level (low/med): LOW__ Date Received: 06/18/91

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

| CAS No. | Analyte | Concentration | C | Q | M |
|---|---|---|---|---|---|
| 7429-90-5 | Aluminum_ | 50.0 | U | | P_ |
| 7440-36-0 | Antimony_ | 5.0 | U | | F_ |
| 7440-38-2 | Arsenic__ | 5.0 | U | W UJ | F_ |
| 7440-39-3 | Barium___ | 50.8 | B | | P_ |
| 7440-41-7 | Beryllium | 5.0 | U | | P_ |
| 7440-43-9 | Cadmium__ | 9.6 | | | P_ |
| 7440-70-2 | Calcium__ | 124000 | J | E | P_ |
| 7440-47-3 | Chromium_ | 10.0 | U | | P_ |
| 7440-48-4 | Cobalt___ | 20.0 | U | | P_ |
| 7440-50-8 | Copper___ | 5.0 | U | | P_ |
| 7439-89-6 | Iron_____ | 22600 | J | E | P_ |
| 7439-92-1 | Lead_____ | 3.0 | U | W UJ | F_ |
| 7439-95-4 | Magnesium | 19000 | J | E | P_ |
| 7439-96-5 | Manganese | 2400 | J | E | P_ |
| 7439-97-6 | Mercury__ | 1.6 | | | CV |
| 7440-02-0 | Nickel___ | 40.7 | | | P_ |
| 7440-09-7 | Potassium | 6430 | | | P_ |
| 7782-49-2 | Selenium_ | 5.0 | U | W UJ | F_ |
| 7440-22-4 | Silver___ | 9.0 | B | | A_ |
| 7440-23-5 | Sodium___ | 40000 | J | E | P_ |
| 7440-28-0 | Thallium_ | 5.0 | U | | F_ |
| 7440-62-2 | Vanadium_ | 30.0 | U | | P_ |
| 7440-66-6 | Zinc_____ | 21.5 | | | P_ |
| | Cyanide__ | | | | NR |

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: ______

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: ______

Comments:

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MW4

Lab Name: RECRA_ENVIRONMENTAL_INC._ Contract: Q90-322___

Lab Code: RECNY_ Case No.: 2602_ SAS No.: ______ SDG No.: 122___

Matrix (soil/water): WATER Lab Sample ID: 5899______

Level (low/med): LOW__ Date Received: 06/18/91

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

| CAS No. | Analyte | Concentration | C | Q | M |
|---|---|---|---|---|---|
| 7429-90-5 | Aluminum_ | 50.0 | U | | P_ |
| 7440-36-0 | Antimony_ | 5.0 | U | | F_ |
| 7440-38-2 | Arsenic__ | 6.0 | B | | F_ |
| 7440-39-3 | Barium___ | 41.4 | B | | P_ |
| 7440-41-7 | Beryllium | 5.0 | U | | P_ |
| 7440-43-9 | Cadmium__ | 5.3 | _ | | P_ |
| 7440-70-2 | Calcium__ | 216000 | _ | E | P_ |
| 7440-47-3 | Chromium_ | 10.0 | U | | P_ |
| 7440-48-4 | Cobalt___ | 20.0 | U | | P_ |
| 7440-50-8 | Copper___ | 5.9 | B | | P_ |
| 7439-89-6 | Iron_____ | 7020 | | E | P_ |
| 7439-92-1 | Lead_____ | 3.0 | U | W UJ | F_ |
| 7439-95-4 | Magnesium | 38600 | | E | P_ |
| 7439-96-5 | Manganese | 7530 | | E | P_ |
| 7439-97-6 | Mercury__ | 0.20 | U | | CV |
| 7440-02-0 | Nickel___ | 222 | | | P_ |
| 7440-09-7 | Potassium | 4770 | B | | P_ |
| 7782-49-2 | Selenium_ | 5.0 | U | W UJ | F_ |
| 7440-22-4 | Silver___ | 10.0 | | | A_ |
| 7440-23-5 | Sodium___ | 71000 | _ | E | P_ |
| 7440-28-0 | Thallium_ | 5.0 | U | | F_ |
| 7440-62-2 | Vanadium_ | 30.0 | U | | P_ |
| 7440-66-6 | Zinc_____ | 23.3 | _ | | P_ |
| | Cyanide__ | | _ | | NR |

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: ______

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: ______

Comments:

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1
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EPA SAMPLE NO.

SOL MW2

Lab Name: RECRA_ENVIRONMENTAL_INC._ Contract: Q90-322___

Lab Code: RECNY_ Case No.: 2602_ SAS No.: ______ SDG No.: 122___

Matrix (soil/water): WATER Lab Sample ID: SOL MW2___

Level (low/med): LOW__ Date Received: 06/18/91

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

| CAS No. | Analyte | Concentration | C | Q | M |
|---|---|---|---|---|---|
| 7429-90-5 | Aluminum | 71.8 | B | | P |
| 7440-36-0 | Antimony | 5.0 | U | W | F |
| 7440-38-2 | Arsenic | 5.0 | B | | F |
| 7440-39-3 | Barium | 42.1 | B | | P |
| 7440-41-7 | Beryllium | 5.0 | U | | P |
| 7440-43-9 | Cadmium | 5.0 | U | | P |
| 7440-70-2 | Calcium | 223000 | | E | P |
| 7440-47-3 | Chromium | 10.0 | U | | P |
| 7440-48-4 | Cobalt | 20.0 | U | | P |
| 7440-50-8 | Copper | 5.0 | U | | P |
| 7439-89-6 | Iron | 7290 | | E | P |
| 7439-92-1 | Lead | 3.0 | U | | F |
| 7439-95-4 | Magnesium | 40000 | | E | P |
| 7439-96-5 | Manganese | 7830 | | E | P |
| 7439-97-6 | Mercury | 0.20 | U | | CV |
| 7440-02-0 | Nickel | 220 | | | P |
| 7440-09-7 | Potassium | 5050 | | | P |
| 7782-49-2 | Selenium | 5.0 | U | | F |
| 7440-22-4 | Silver | 5.0 | U | | A |
| 7440-23-5 | Sodium | 74200 | | E | P |
| 7440-28-0 | Thallium | 5.0 | U | | F |
| 7440-62-2 | Vanadium | 30.0 | U | | P |
| 7440-66-6 | Zinc | 6.6 | B | | P |
| | Cyanide | | | | NR |

Color Before: ________ Clarity Before: ______ Texture: ______

Color After: ________ Clarity After: ______ Artifacts: ______

Comments:
SOLUBLE_METALS

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1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

S1 0-1

Lab Name: RECRA_ENVIRONMENTAL_INC._ Contract: Q90-322___

Lab Code: RECNY_ Case No.: 2602_ SAS No.: ______ SDG No.: 121___

Matrix (soil/water): SOIL_ Lab Sample ID: 6084______

Level (low/med): LOW__ Date Received: 05/14/91

% Solids: _88.1

Concentration Units (ug/L or mg/kg dry weight): MG/KG

| CAS No. | Analyte | Concentration | C | Q | M |
|---|---|---|---|---|---|
| 7429-90-5 | Aluminum | | | | NR |
| 7440-36-0 | Antimony | | | | NR |
| 7440-38-2 | Arsenic | | | | NR |
| 7440-39-3 | Barium | | | | NR |
| 7440-41-7 | Beryllium | | | | NR |
| 7440-43-9 | Cadmium | | | | NR |
| 7440-70-2 | Calcium | | | | NR |
| 7440-47-3 | Chromium | | | | NR |
| 7440-48-4 | Cobalt | | | | NR |
| 7440-50-8 | Copper | | | | NR |
| 7439-89-6 | Iron | | | | NR |
| 7439-92-1 | Lead | 154 | | * | A |
| 7439-95-4 | Magnesium | | | | NR |
| 7439-96-5 | Manganese | | | | NR |
| 7439-97-6 | Mercury | | | | NR |
| 7440-02-0 | Nickel | | | | NR |
| 7440-09-7 | Potassium | | | | NR |
| 7782-49-2 | Selenium | | | | NR |
| 7440-22-4 | Silver | | | | NR |
| 7440-23-5 | Sodium | | | | NR |
| 7440-28-0 | Thallium | | | | NR |
| 7440-62-2 | Vanadium | | | | NR |
| 7440-66-6 | Zinc | | | | NR |
| | Cyanide | | | | NR |

Color Before: BLACK____ Clarity Before: ______ Texture: MEDIUM

Color After: YELLOW___ Clarity After: CLEAR_ Artifacts: ______

Comments:

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1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

S3 0-1

Lab Name: RECRA_ENVIRONMENTAL_INC._ Contract: Q90-322___

Lab Code: RECNY_ Case No.: 2602_ SAS No.: _______ SDG No.: 121___

Matrix (soil/water): SOIL_ Lab Sample ID: 6086______

Level (low/med): LOW__ Date Received: 05/14/91

% Solids: _86.0

Concentration Units (ug/L or mg/kg dry weight): MG/KG

| CAS No. | Analyte | Concentration | C | Q | M |
|---|---|---|---|---|---|
| 7429-90-5 | Aluminum | | | | NR |
| 7440-36-0 | Antimony | | | | NR |
| 7440-38-2 | Arsenic | | | | NR |
| 7440-39-3 | Barium | | | | NR |
| 7440-41-7 | Beryllium | | | | NR |
| 7440-43-9 | Cadmium | | | | NR |
| 7440-70-2 | Calcium | | | | NR |
| 7440-47-3 | Chromium | | | | NR |
| 7440-48-4 | Cobalt | | | | NR |
| 7440-50-8 | Copper | | | | NR |
| 7439-89-6 | Iron | | | | NR |
| 7439-92-1 | Lead | 625 | | * | A |
| 7439-95-4 | Magnesium | | | | NR |
| 7439-96-5 | Manganese | | | | NR |
| 7439-97-6 | Mercury | | | | NR |
| 7440-02-0 | Nickel | | | | NR |
| 7440-09-7 | Potassium | | | | NR |
| 7782-49-2 | Selenium | | | | NR |
| 7440-22-4 | Silver | | | | NR |
| 7440-23-5 | Sodium | | | | NR |
| 7440-28-0 | Thallium | | | | NR |
| 7440-62-2 | Vanadium | | | | NR |
| 7440-66-6 | Zinc | | | | NR |
| | Cyanide | | | | NR |

Color Before: BLACK____ Clarity Before: ______ Texture: MEDIUM

Color After: YELLOW___ Clarity After: CLEAR_ Artifacts: ______

Comments:

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1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

S5 0-1

Lab Name: RECRA_ENVIRONMENTAL_INC._ Contract: Q90-322___

ab Code: RECNY_ Case No.: 2602_ SAS No.: ______ SDG No.: 121___

Matrix (soil/water): SOIL_ Lab Sample ID: 6088______

evel (low/med): LOW__ Date Received: 05/14/91

% Solids: _78.1

Concentration Units (ug/L or mg/kg dry weight): MG/KG

| CAS No. | Analyte | Concentration | C | Q | M |
|---|---|---|---|---|---|
| 7429-90-5 | Aluminum_ | | | | NR |
| 7440-36-0 | Antimony_ | | | | NR |
| 7440-38-2 | Arsenic__ | | | | NR |
| 7440-39-3 | Barium___ | | | | NR |
| 7440-41-7 | Beryllium | | | | NR |
| 7440-43-9 | Cadmium__ | | | | NR |
| 7440-70-2 | Calcium__ | | | | NR |
| 7440-47-3 | Chromium_ | | | | NR |
| 7440-48-4 | Cobalt___ | | | | NR |
| 7440-50-8 | Copper___ | | | | NR |
| 7439-89-6 | Iron_____ | | | | NR |
| 7439-92-1 | Lead_____ | 6760 | | * | A_ |
| 7439-95-4 | Magnesium | | | | NR |
| 7439-96-5 | Manganese | | | | NR |
| 7439-97-6 | Mercury__ | | | | NR |
| 7440-02-0 | Nickel___ | | | | NR |
| 7440-09-7 | Potassium | | | | NR |
| 7782-49-2 | Selenium_ | | | | NR |
| 7440-22-4 | Silver___ | | | | NR |
| 7440-23-5 | Sodium___ | | | | NR |
| 7440-28-0 | Thallium_ | | | | NR |
| 7440-62-2 | Vanadium_ | | | | NR |
| 7440-66-6 | Zinc_____ | | | | NR |
| | Cyanide__ | | | | NR |

olor Before: BLACK____ Clarity Before: ______ Texture: MEDIUM

Color After: YELLOW___ Clarity After: CLEAR_ Artifacts: ______

omments:

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1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

S7 0-1

Lab Name: RECRA_ENVIRONMENTAL_INC._ Contract: Q90-322___

Lab Code: RECNY_ Case No.: 2602_ SAS No.: ______ SDG No.: 121___

Matrix (soil/water): SOIL_ Lab Sample ID: 6090______

Level (low/med): LOW__ Date Received: 05/14/91

% Solids: _81.5

Concentration Units (ug/L or mg/kg dry weight): MG/KG

| CAS No. | Analyte | Concentration | C | Q | M |
|---|---|---|---|---|---|
| 7429-90-5 | Aluminum | | | | NR |
| 7440-36-0 | Antimony | | | | NR |
| 7440-38-2 | Arsenic | | | | NR |
| 7440-39-3 | Barium | | | | NR |
| 7440-41-7 | Beryllium | | | | NR |
| 7440-43-9 | Cadmium | | | | NR |
| 7440-70-2 | Calcium | | | | NR |
| 7440-47-3 | Chromium | | | | NR |
| 7440-48-4 | Cobalt | | | | NR |
| 7440-50-8 | Copper | | | | NR |
| 7439-89-6 | Iron | | | | NR |
| 7439-92-1 | Lead | 10500 | | * | A |
| 7439-95-4 | Magnesium | | | | NR |
| 7439-96-5 | Manganese | | | | NR |
| 7439-97-6 | Mercury | | | | NR |
| 7440-02-0 | Nickel | | | | NR |
| 7440-09-7 | Potassium | | | | NR |
| 7782-49-2 | Selenium | | | | NR |
| 7440-22-4 | Silver | | | | NR |
| 7440-23-5 | Sodium | | | | NR |
| 7440-28-0 | Thallium | | | | NR |
| 7440-62-2 | Vanadium | | | | NR |
| 7440-66-6 | Zinc | | | | NR |
| | Cyanide | | | | NR |

Color Before: BLACK____ Clarity Before: ______ Texture: MEDIUM

Color After: YELLOW___ Clarity After: CLEAR_ Artifacts: ______

Comments:

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1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

S9 0-1

Lab Name: RECRA_ENVIRONMENTAL_INC._ Contract: Q90-322___

Lab Code: RECNY_ Case No.: 2602_ SAS No.: ______ SDG No.: 121___

Matrix (soil/water): SOIL_ Lab Sample ID: 6092______

Level (low/med): LOW__ Date Received: 05/14/91

% Solids: _74.4

Concentration Units (ug/L or mg/kg dry weight): MG/KG

| CAS No. | Analyte | Concentration | C | Q | M |
|---|---|---|---|---|---|
| 7429-90-5 | Aluminum | | | | NR |
| 7440-36-0 | Antimony | | | | NR |
| 7440-38-2 | Arsenic | | | | NR |
| 7440-39-3 | Barium | | | | NR |
| 7440-41-7 | Beryllium | | | | NR |
| 7440-43-9 | Cadmium | | | | NR |
| 7440-70-2 | Calcium | | | | NR |
| 7440-47-3 | Chromium | | | | NR |
| 7440-48-4 | Cobalt | | | | NR |
| 7440-50-8 | Copper | | | | NR |
| 7439-89-6 | Iron | | | | NR |
| 7439-92-1 | Lead | 3820 | | * | A |
| 7439-95-4 | Magnesium | | | | NR |
| 7439-96-5 | Manganese | | | | NR |
| 7439-97-6 | Mercury | | | | NR |
| 7440-02-0 | Nickel | | | | NR |
| 7440-09-7 | Potassium | | | | NR |
| 7782-49-2 | Selenium | | | | NR |
| 7440-22-4 | Silver | | | | NR |
| 7440-23-5 | Sodium | | | | NR |
| 7440-28-0 | Thallium | | | | NR |
| 7440-62-2 | Vanadium | | | | NR |
| 7440-66-6 | Zinc | | | | NR |
| | Cyanide | | | | NR |

Color Before: BLACK____ Clarity Before: ______ Texture: MEDIUM

Color After: YELLOW___ Clarity After: CLEAR_ Artifacts: ______

Comments:

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# TRANSMITTAL INFORMATION SHEET

**DATE:** July 8, 1991

**The following pages are for:**

**NAME** Ms. Janet Hall

**FIRM** Engineering Science, Inc.

**ADDRESS** ______________________

______________________

**FAX NUMBER** 1-313-433-0835

**FROM** ______________________

**SPECIAL INSTRUCTIONS** ______________________

______________________

______________________

______________________

______________________

Total number of pages 3 (including information sheet).

If you have any problems during the transmission of these documents, please call (716) 691-2600, extension ______.

Recra Environmental, Inc.
10 Hazelwood Drive
Amherst, NY 14228-2298

Telephone: (716) 691-2600
Fax No.: (716) 691-3011

Please feel free to contact me if you require further clarification of Recra Environmental's analytical procedures. We are always pleased to receive your comments and recommendations.

Sincerely,

Recra Environmental, Inc.

Verl D. Preston
Director/Customer Service

VDP/ew

ECRA ENVIRONMENTAL, INC.

# APPENDIX G

# GEOTECHNICAL LABORATORY RESULTS

R&R
INTERNATIONAL, INC.

1234 S. CLEVELAND-MASSILLON ROAD
P.O. BOX 4383
AKRON, OHIO 44321
(216) 666-2200

October 17, 1990

Mr. Bill Lilly
Engineering Science, Inc.
290 Elwood Davis-Road
Liverpool, N.Y. 13008

**Reference: Houdaille-Manzell SYO 117.02**
**Project Number 001004**

Dear Mr. Lilly,

Enclosed are the moisture (ASTM D 2216-80) and Gradation (ASTM D 422-63) analysis reports for the Houdaille-Manzell SYO-117.02 project. The hydrometer results to follow under a separate cover.

If you should have any questions, feel free to call.

Respectfully,

**R & R INTERNATIONAL, INC.**

Larry Blasio
Manager-Material Testing

LB:slh

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OCT
ES SYRACUSE

R&R
INTERNATIONAL,INC.

1234 S. CLEVELAND-MASSILLON ROAD
P.O. BOX 4383,
AKRON, OHIO 44321
(216) 666-2200

November 28, 1990

Mr. Bill Lilly
Engineering Science, Inc.
290 Elwood Davis-Road
Liverpool, N.Y. 13008

**Reference: Houdaille-Manzell SYO 117.02**
**Project Number 001004**

Dear Mr. Lilly,

Enclosed are the moisture (ASTM D 2216-80) and Gradation (ASTM D 422-63) analysis reports for the Houdaille-Manzell SYO-117.02 project. The hydrometer results to follow under a separate cover.

If you should have any questions, feel free to call.

Respectfully,

**R & R INTERNATIONAL, INC.**

Larry Blasio
Manager-Material Testing

LB:slh

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ES SYRACUSE

R&R INTERNATIONAL, INC.

PROJECT: SYO-117.02 PROJECT NUMBER: 001004

# TRIAXIAL FLEXI-WALL PERMEABILITY

EPA 9100 ASTM D-5084 pending

| BORING NUMBER | DEPTH ft. | MOISTURE PERCENT | UNIT WET WEIGHT pcf | UNIT DRY WEIGHT pcf | CONSOLIDATION PRESSURE tsf | AVERAGE GRADIENT i | PERMEABILITY cm/sec |
|---|---|---|---|---|---|---|---|
| MW-1 | 12.0-14.0 | 21.1 | 126.7 | 104.6 | 0.86 | 80.4 | 6.16E-08 |
| MW-2 | 6.0-8.0 | 21.6 | 129.2 | 106.3 | 0.50 | 42.3 | 2.08E-08 |
| MW-3 | 6.0-8.0 | 22.8 | 124.7 | 101.6 | 0.50 | 41.3 | 2.35E-08 |
| MW-4 | 8.0-10.0 | 26.7 | 120.8 | 95.3 | 0.58 | 48.8 | 4.01E-08 |

# APPENDIX H

## RESPONSES TO NYSDEC COMMENTS

# APPENDIX H.1 RESPONSES TO APRIL 29, 1991 COMMENTS PERTAINING TO PHASE I RI/FS REPORT

## RESPONSES TO NYSDEC COMMENTS DATED APRIL 29, 1991 PERTAINING TO PHASE I RI/FS REPORT HOUDAILLE-MANZEL SITE

### PAGE 1-4 COMMENT

The first line should be changed to read "No groundwater samples have been previously collected...".

### PAGE 1-4 RESPONSE

**The sentence has been revised as commented by the NYSDEC.**

### PAGE 1-5 COMMENT

In the "Phase II Report" paragraph, it should read "Division of Hazardous Waste Remediation".

### PAGE 1-5 RESPONSE

**"Diversion" was a typo and has been corrected to "Division".**

### PAGE 2-8 COMMENT

In the last paragraph, change it to state that monitoring wells were constructed of stainless steel, not PVC.

### PAGE 2-8 RESPONSE

**"PVC" has been changed to "stainless steel" as commented.**

### PAGE 4-2 COMMENT

In the first paragraph it is stated that the "numbered grid points are shown on Figure 4.1", however, referring to that figure the grid points have not been numbered.

### PAGE 4-2 RESPONSE

**Figure 4.1 has been revised to include all numbered grid points.**

### TABLE 4.2 COMMENT

The grid coordinates listed in the left hand column have not been presented on the site maps.

### TABLE 4.2 RESPONSE

**Grid coordinates have been added to all figures in this section.**

**TABLE 4.3 COMMENT**

Either here or on the site map explicitly identify which samples are sewer sediment samples.

**TABLE 4.3 RESPONSE**

**Descriptive identification has been added to Table 4.3 for the two sewer samples.**

**PAGE 4-3 COMMENT**

At the end of the paragraph the wording should be changed from "...areas requiring cleanup." There has been do determination made that cleanup is necessary.

**PAGE 4-3 RESPONSE**

**The wording "...limits of area requiring cleanup" has been revised to "...limits of contamination".**

**TABLE 4.4 COMMENT**

The standard for characterizing a sample as a characteristic hazardous waste for lead, using the EP Toxicity procedure, is 5 ppm.

**TABLE 4.4 RESPONSE**

**The typo in EP Toxicity standard for lead has been corrected to 5 ppm.**

**PAGE 4-7 COMMENT**

At the end of the first paragraph under the section entitled "Extent of Contamination", please insert the work <u>relatively</u> before impermeable.

**PAGE 4-7 RESPONSE**

**The word "relatively" has been inserted as commented.**

**PAGE 5-5 COMMENT**

Under the section entitled "Environmental Exposure" only Aroclor 1254 was discussed relative to the sewer sediment samples. The total PCB concentration were slightly greater since Aroclor 1242 and 1260 were also detected in the samples.

**PAGE 5-5 RESPONSE**

**The discussion has been revised to include all Aroclors detected.**

**PAGE 7-1 COMMENT**

In the first remedial objective change "...6000 cubic yards of source material" to "...6000 cubic yards of material".

**PAGE 7-1 RESPONSE**

**The word "source" has been deleted.**

**TABLE 7.3 COMMENT**

The following corrections need to be made to this table:

| | | |
|---|---|---|
| Cobalt | - | Class D - 110 (G) |
| Mercury | - | Class B - .2 (G) |
| | - | Class D - .2 (G) |
| Sodium | - | Groundwater Standard - 20,000 |
| Zinc | - | Groundwater Standard - 300 |

**TABLE 7.3 RESPONSE**

**The corrections have been made as commented.**

**TABLE 7.5 COMMENT**

State regulations considered to be applicable are New York State Standards Criteria and Guidance values (SCGs); Federal regulations are called Applicable or Relevant and Appropriate Requirements (ARARs). Since both ARARs and SCGs are included please revise the column heading to "Potential SCGs/ARARs".

**TABLE 7.5 RESPONSE**

**In the third introductional paragraph under Section 7.3 and on page 4 of TAGM HWR-90-4030), it is stated that SCGs include those federal standards which are more stringent than the state standards. Therefore, it was not considered necessary to include both SCGs and ARARs in the column heading.**

**TABLE 7.5 COMMENT**

Under "Placement in Off-Site Landfill" you should include the Resource Conservation and Recovery Act (RCRA) land disposal restrictions (LDRs), established under the Hazardous and Solid Waste Amendments (HSWA), as a potential SCGs/ARARs.

**TABLE 7.5 RESPONSE**

**The RCRA land disposal restrictions (LDRs) have been included as a potential SCG under "Placement in Off-Site Landfill".**

**TABLE 7.7 COMMENT**

The "No Action" alternative should be carried through for each category.

**TABLE 7.7 RESPONSE**

**The "No Action" has been added to the remaining two categories in Table 7.7.**

**APPENDIX D COMMENT**

Either within this appendix or in Section 3 present relative groundwater levels (above mean seal level) so that groundwater flow direction and gradients can be directly interpreted by the reader.

**APPENDIX D RESPONSE**

**Table D.1 "Water Level Data" has been added to Appendix D to provide this information.**

# APPENDIX H.2 RESPONSES TO SEPTEMBER 12, 1991 COMMENTS PERTAINING TO PHASE II RI/FS REPORT (NEW SECTIONS)

# RESPONSES TO NYSDEC COMMENTS DATED SEPTEMBER 12, 1991 PERTAINING TO PHASE II RI/FS REPORT HOUDAILLE-MANZEL SITE

## COMMENT

Page 8-2, Alternative 2 - I assume that Figure 8.1 defines Areas 1, 2, 3 and 4 which are discussed in this paragraph (Figure 8.1 was not provided). If not, please define Areas 1, 2, 3 and 4.

Also with this paragraph, I believe that Area 3 is along Imson Street east of the former building.

## RESPONSE

**Figure 8.1 has been provided. Area 3 is located east of the former building as pointed out by NYSDEC.**

## COMMENT

General Comments - Within the "capping" options you should include the clay/topsoil low permeability cap as well as a basic soil cap. The soil cap, combined with a hot spot removal would address the goals of the remedial program. Since the areas of high lead levels would be removed, a low permeability layer would not be necessary.

## RESPONSE

**Alternative 5 has been added which includes "hot spot" removal, and a basic soil cap and a concrete cap. The concrete cap is necessary for the area along Imson Street because the limited space available would not allow any transition grading from the soil cap to surrounding public road surface.**

# APPENDIX H.3 RESPONSES TO NOVEMBER 4, 1991 COMMENTS PERTAINING TO DRAFT RI/FS REPORT

# RESPONSES TO NYSDEC COMMENTS DATED NOVEMBER 4, 1991
# PERTAINING TO DRAFT RI/FS REPORT
# HOUDAILLE-MANZEL SITE

## COMMENT

Since the FS is a part of the Report, and the FS contains a Conceptual Design, the Report should be certified by a licensed Professional Engineer (P.E.) authorized to practice in New York State.

## RESPONSE

**Report has been reviewed and certified by a licensed Professional Engineer (P.E.) authorized to practice in New York State. All copies submitted have been stamped.**

## COMMENT

Page 1-12, Figure 1.3 - If possible the sample points indicated on this figure need to be identified so that the results can be evaluated without referring to other documents.

## RESPONSE

**Figure 1.3 and Table 1.2 have been modified to allow correlation of sample points on Figure 1.3 to results presented in Table 1.2.**

## COMMENT

Page 1-25, Section 1.2.3.2 - The statement "...volatile organic analysis detected no priority pollutants at 10 ppb or less in TP/MW-4 (JEB, 1988)". Is this statement indicating the analyses were all non-detect at a detection limit of 10 ppb or is it indicating that all of the VOCs were above 10 ppb?

## RESPONSE

**Statement has been revised to more clearly reflect that all analytical results were below detection limits. The highest detection limit was 10 ppb.**

## COMMENT

Page 2-8, Section 2.1.6 - It is stated that "Four grid points read by XFR analysis did not correlate with laboratory results, therefore, no further field readings were taken." Please expand upon this discussion to indicate where the samples were and the difference in the results between the two analyses.

## RESPONSE

**Discussion has been expanded.**

**COMMENT**

Pages 2-20 through 2-23, Figures 2.9 through 2.11A - These figures have not been included in the "List of Figures". Please revise the table of contents to reflect their presence.

**RESPONSE**

**The table of contents has been revised to include the figures.**

**COMMENT**

Page 3-4, Section 3.6.1 - The residential neighborhoods are located south of the site rather than north of the site.

**RESPONSE**

**The wording has been changed to "south of the site".**

**COMMENT**

Page 4-22, Table 4.5 - The date of collection for the tabulated samples should be included.

**RESPONSE**

**The date of sampling has been added to Table 4.5.**

**COMMENT**

Page 4-35, Section 4.4.4 - In this section the Phase II RI and the 7/91 NYSDEC samples results are discussed. It would be appropriate to make references to Figures 2.9 through 2.11A.

**RESPONSE**

**A sentence has been added to reference soil sample locations to Figures 2.9 through 2.11A.**

**COMMENT**

Pages 4-36 and 4-37, Tables 4.9 and 4.10 - Please include dates for the Phase II samples.

**RESPONSE**

**The dates of sampling have been included in Tables 4.9 and 4.10.**

**COMMENT**

Pages 6-1, 7-1, 9-5, 10-2, etc. - As I discuss below, there has been much discussion relative to defining the boundaries of the Houdaille-Manzel site. On the pages listed (the list may not be all inclusive) the discussion needs to be reworded to indicate that hazardous waste was identified as a result of samples taken during the Houdaille-Manzel RI.

RESPONSE

**Pages 6-1, 7-1, 9-5, 10-2, etc., have been revised to identify the yard of 171 Imson Street as off-site. The discussion has been reworded as requested.**

COMMENT

Appendix C - Groundwater levels are inferred on Figure 2 of Appendix C. In Appendix D the well sampling record indicates the depth of water, however the well casing elevation is not given. The groundwater levels (AMSL) need to be explicitly presented somewhere within the Report.

RESPONSE

**These groundwater levels (AMSL) are presented in Table D-1.**

COMMENT

As you know there have been discussions relative to the boundaries of this site and whether the presence of EP Toxicity lead levels above the level for a characteristic hazardous waste are associated with past disposal practices at this site. Although lead has been found at elevated levels in known disposal areas (under bridge and along fence) the levels detected are similar to those found in urban areas. One sample, taken under the bridge by the responsible party in 1983, showed an EP Toxicity lead level of 5.2 ppm. Although that analysis was above the regulatory level for a hazardous waste (5.0 ppm) it was marginal and has never been reproduced.

The lead concentrations in the yard at 171 Imson Street showed levels much higher than those found under the bridge. The sample locations at 171 Imson which produced the EP Toxicity lead results above regulatory levels were 50 to 100 feet east of the fence. Based on the historical disposal along the fence, the ground surface being relatively flat and the soil being very permeable, it is unlikely that disposal of material along the fence is the source of the contamination in the yard at 171 Imson Street.

As a result of the discussion above the Department has taken the position that the hazardous waste identified during the RI for the Houdaille-Manzel site is not located on-site and is not the result of past disposal practices from this site. The only sample from beneath the bridge which exceeded EP Toxicity regulatory levels was very marginal and extensive sampling since then has never been able to reproduce that result.

Taking all of these factors into consideration the NO ACTION alternative should be chosen for the Houdaille-Manzel site. The property at 171 Imson Street needs to be addressed, however, it will be dealt with as a separate issue unrelated to the Houdaille-Manzel site.

## RESPONSE

The final report has been revised to recommend the no action alternative based on the fact that the hazardous waste was found off-site.

# APPENDIX I

# TAGM TABLES FOR SCREENING ANALYSIS

HOUDAILLE-MANZEL SITE
ALTERNATIVE 1 - NO ACTION/LONG-TERM MONITORING

**SHORT-TERM/LONG-TERM EFFECTIVENESS**
(Maximum Score = 25)

| Analysis Factor | Basis for Evaluation During Preliminary Screening | | | | Score |
|---|---|---|---|---|---|
| 1. Protection of community during remedial actions. | • Are there significant short-term risks to the community that must be addressed? **(If answer is no, go to Factor 2.)** | **Yes**<br>**No** | __<br>x | 0<br>4 | |
| | • Can the short-term risk be easily controlled? | **Yes**<br>**No** | __<br>__ | 1<br>0 | |
| | • Does the mitigative effort to control short-term risk impact the community life-style? | **Yes**<br>**No** | __<br>__ | 0<br>2 | 4 |
| **Subtotal (maximum = 4)** | | | | | |
| 2. Environmental Impacts | • Are there significant short-term risks to the environment that must be addressed? **(If answer is no, go to Factor 3.)** | **Yes**<br>**No** | __<br>x | 0<br>4 | |
| | • Are the available mitigative measures reliable to minimize potential impacts? | **Yes**<br>**No** | __<br>__ | 3<br>0 | 4 |
| **Subtotal (maximum = 4)** | | | | | |
| 3. Time to implement the remedy. | • What is the required time to implement the remedy? | **≤ 2 yr.**<br>**> 2 yr.** | x<br>__ | 1<br>0 | |
| | • Required duration of the mitigative effort to control short-term risk. | **≤ 2 yr.**<br>**> 2 yr.** | x<br>__ | 1<br>0 | 2 |
| **Subtotal (maximum = 2)** | | | | | |
| 4. On-site or off-site treatment or land disposal. | • On-site treatment*<br>• Off-site treatment*<br>• On-site or off-site land disposal | | __<br>__<br>x | 3<br>1<br>0 | 0 |
| **Subtotal (maximum = 3)** | | | | | |

* treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes

## SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

| Analysis Factor | | Basis for Evaluation During Preliminary Screening | | | Score | |
|---|---|---|---|---|---|---|
| 5. Permanence of the remedial alternative. | • | Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 7.)** | **Yes** | ___ | 3 | |
| | | | **No** | _x_ | 0 | 0 |
| **Subtotal (maximum = 3)** | | | | | | |
| 6. Lifetime of remedial actions. | • | Expected lifetime or duration of effectiveness of the remedy. | **25-30 yr.** | _x_ | 3 | |
| | | | **20-25 yr.** | ___ | 2 | |
| | | | **15-20 yr.** | ___ | 1 | |
| | | | **< 15 yr.** | ___ | 0 | 3 |
| **Subtotal (maximum = 3)** | | | | | | |
| 7. Quantity and nature of waste or residual left at the site after remediation. | i) | Quantity of untreated hazardous waste left at the site. | **None** | _x_ | 3 | |
| | | | **≤ 25%** | ___ | 2 | |
| | | | **25-50%** | ___ | 1 | |
| | | | **≥ 50%** | ___ | 0 | |
| | ii) | Is there treated residual left at the site? **(If answer is no, go to Factor 8.)** | **Yes** | ___ | 0 | |
| | | | **No** | _x_ | 2 | |
| | iii) | Is the treated residual toxic? | **Yes** | ___ | 0 | |
| | | | **No** | ___ | 1 | |
| | iv) | Is the treated residual mobile? | **Yes** | ___ | 0 | |
| | | | **No** | ___ | 1 | 5 |
| **Subtotal (maximum = 5)** | | | | | | |

HOUDAILLE-MANZEL SITE
ALTERNATIVE 1 - NO ACTION/LONG-TERM MONITORING (Continued)

## SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

| Analysis Factor | | Basis for Evaluation During Preliminary Screening | | | Score | |
|---|---|---|---|---|---|---|
| 8. Adequacy and reliability of controls. | i) | Operation and maintenance required for a period of: | **< 5 yr.** | x | 1 | |
| | | | **> 5 yr.** | | 0 | |
| | ii) | Are environmental controls required as a part of the remedy to handle potential problems? **(If answer is no go to "iv".)** | **Yes** | | 0 | |
| | | | **No** | x | 1 | |
| | iii) | Degree of confidence that controls can adequately handle potential problems. | **Moderate to very confident** | | 1 | |
| | | | **Somewhat to not confident** | x | 0 | |
| | iv) | Relative degree of long-term monitoring required **(compare with other remedial alternatives.)** | **Minimum** | x | 2 | |
| | | | **Moderate** | | 1 | |
| | | | **Extensive** | | 0 | |
| **Subtotal (maximum = 4)** | | | | | | 4 |
| **TOTAL (Maximum = 25)** | | | | | | 22 |

**IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.**

HOUDAILLE-MANZEL SITE
ALTERNATIVE 1 - NO ACTION/LONG-TERM MONITORING (Continued)

**IMPLEMENTABILITY**
(Maximum Score = 15)

| Analysis Factor | | Basis for Evaluation During Preliminary Screening | | Score | |
|---|---|---|---|---|---|
| 1. Technical Feasibility | | | | | |
| a. Ability to construct technology. | i) | Not difficult to construct. No uncertainties in construction. | x | 3 | |
| | ii) | Somewhat difficult to construct. No uncertainties in construction. | ___ | 2 | |
| | iii) | Very difficult to construct and/or significant uncertainties in construction. | ___ | 1 | |
| b. Reliability of technology. | i) | Very reliable in meeting the specified process efficiencies or performance goals. | ___ | 3 | |
| | ii) | Somewhat reliable in meeting the specified process efficiencies or performance goals. | x | 2 | |
| c. Schedule of delays due to technical problems. | i) | Unlikely | x | 2 | |
| | ii) | Somewhat likely | ___ | 1 | |
| d. Need of undertaking additional remedial action, if necessary. | i) | No future remedial actions may be anticipated. | x | 2 | |
| | ii) | Some future remedial actions may be necessary. | ___ | 1 | 9 |
| **Subtotal (maximum = 10)** | | | | | |
| 2. Administrative Feasibility | | | | | |
| a. Coordination with other agencies. | i) | Minimal coordination is required. | x | 2 | |
| | ii) | Required coordination is normal. | ___ | 1 | |
| | iii) | Extensive coordination is required. | ___ | 0 | 2 |
| **Subtotal (maximum = 2)** | | | | | |

HOUDAILLE-MANZEL SITE
ALTERNATIVE 1 - NO ACTION/LONG-TERM MONITORING (Continued)

**IMPLEMENTABILITY**
(Maximum Score = 15)

| Analysis Factor | | Basis for Evaluation During Preliminary Screening | | | Score | |
|---|---|---|---|---|---|---|
| 3. Availability of Services and Materials | | | | | | |
| a. Availability of prospective technologies. | i) | Are technologies under consideration generally commercially available for the site-specific application? | **Yes**<br>**No** | x<br>__ | 1<br>0 | |
| | ii) | Will more than one vendor be available to provide a competitive bid? | **Yes**<br>**No** | x<br>__ | 1<br>0 | |
| b. Availability of necessary equipment and specialists. | i) | Additional equipment and specialists may be available without significant delay. | **Yes**<br>**No** | x<br>__ | 1<br>0 | 3 |
| **Subtotal (maximum = 3)** | | | | | | |
| **TOTAL (Maximum = 15)** | | | | | | 14 |

**IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.**

HOUDAILLE-MANZEL SITE
ALTERNATIVE 2 - CLAY CAP AND CONCRETE CAP

**SHORT-TERM/LONG-TERM EFFECTIVENESS**
(Maximum Score = 25)

| Analysis Factor | | Basis for Evaluation During Preliminary Screening | | | Score | |
|---|---|---|---|---|---|---|
| 1. Protection of community during remedial actions. | • | Are there significant short-term risks to the community that must be addressed? **(If answer is no, go to Factor 2.)** | **Yes**<br>**No** | __<br>x | 0<br>4 | |
| | • | Can the short-term risk be easily controlled? | **Yes**<br>**No** | __<br>__ | 1<br>0 | |
| | • | Does the mitigative effort to control short-term risk impact the community life-style? | **Yes**<br>**No** | __<br>__ | 0<br>2 | 4 |
| **Subtotal (maximum = 4)** | | | | | | |
| 2. Environmental Impacts | • | Are there significant short-term risks to the environment that must be addressed? **(If answer is no, go to Factor 3.)** | **Yes**<br>**No** | __<br>x | 0<br>4 | |
| | • | Are the available mitigative measures reliable to minimize potential impacts? | **Yes**<br>**No** | __<br>__ | 3<br>0 | 4 |
| **Subtotal (maximum = 4)** | | | | | | |
| 3. Time to implement the remedy. | • | What is the required time to implement the remedy? | **≤ 2 yr.**<br>**> 2 yr.** | x<br>__ | 1<br>0 | |
| | • | Required duration of the mitigative effort to control short-term risk. | **≤ 2 yr.**<br>**> 2 yr.** | x<br>__ | 1<br>0 | 2 |
| **Subtotal (maximum = 2)** | | | | | | |
| 4. On-site or off-site treatment or land disposal. | • | On-site treatment* | | __ | 3 | |
| | • | Off-site treatment* | | __ | 1 | |
| | • | On-site or off-site land disposal | | x | 0 | 0 |
| **Subtotal (maximum = 3)** | | | | | | |

* treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes

HOUDAILLE-MANZEL SITE
ALTERNATIVE 2 - CLAY CAP AND CONCRETE CAP (Continued)

## SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

| Analysis Factor | | Basis for Evaluation During Preliminary Screening | | | | Score |
|---|---|---|---|---|---|---|
| 5. Permanence of the remedial alternative. | • | Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 7.)** | **Yes** | ___ | 3 | |
| | | | **No** | x | 0 | |
| | | | | | | 0 |
| **Subtotal (maximum = 3)** | | | | | | |
| 6. Lifetime of remedial actions. | • | Expected lifetime or duration of effectiveness of the remedy. | **25-30 yr.** | x | 3 | |
| | | | **20-25 yr.** | ___ | 2 | |
| | | | **15-20 yr.** | ___ | 1 | |
| | | | **< 15 yr.** | ___ | 0 | |
| | | | | | | 3 |
| **Subtotal (maximum = 3)** | | | | | | |
| 7. Quantity and nature of waste or residual left at the site after remediation. | i) | Quantity of untreated hazardous waste left at the site. | **None** | x | 3 | |
| | | | **≤ 25%** | ___ | 2 | |
| | | | **25-50%** | ___ | 1 | |
| | | | **≥ 50%** | ___ | 0 | |
| | ii) | Is there treated residual left at the site? **(If answer is no, go to Factor 8.)** | **Yes** | ___ | 0 | |
| | | | **No** | x | 2 | |
| | iii) | Is the treated residual toxic? | **Yes** | ___ | 0 | |
| | | | **No** | ___ | 1 | |
| | iv) | Is the treated residual mobile? | **Yes** | ___ | 0 | |
| | | | **No** | ___ | 1 | |
| | | | | | | 5 |
| **Subtotal (maximum = 5)** | | | | | | |

## HOUDAILLE-MANZEL SITE
## ALTERNATIVE 2 - CLAY CAP AND CONCRETE CAP (Continued)

### SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

| Analysis Factor | | Basis for Evaluation During Preliminary Screening | | | | Score |
|---|---|---|---|---|---|---|
| 8. Adequacy and reliability of controls. | i) | Operation and maintenance required for a period of: | **< 5 yr.** | __ | 1 | |
| | | | **> 5 yr.** | x | 0 | |
| | ii) | Are environmental controls required as a part of the remedy to handle potential problems? **(If answer is no go to "iv".)** | **Yes** | x | 0 | |
| | | | **No** | __ | 1 | |
| | iii) | Degree of confidence that controls can adequately handle potential problems. | **Moderate to very confident** | x | 1 | |
| | | | **Somewhat to not confident** | __ | 0 | |
| | iv) | Relative degree of long-term monitoring required **(compare with other remedial alternatives.)** | **Minimum** | x | 2 | |
| | | | **Moderate** | __ | 1 | |
| | | | **Extensive** | __ | 0 | |
| **Subtotal (maximum = 4)** | | | | | | 3 |
| **TOTAL (Maximum = 25)** | | | | | | 21 |

**IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATJVE FROM FURTHER CONSIDERATION.**

HOUDAILLE-MANZEL SITE
ALTERNATIVE 2 - CLAY CAP AND CONCRETE CAP (Continued)

**IMPLEMENTABILITY**
(Maximum Score = 15)

| Analysis Factor | | Basis for Evaluation During Preliminary Screening | | Score | |
|---|---|---|---|---|---|
| 1. Technical Feasibility | | | | | |
| a. Ability to construct technology. | i) | Not difficult to construct. No uncertainties in construction. | x | 3 | |
| | ii) | Somewhat difficult to construct. No uncertainties in construction. | ___ | 2 | |
| | iii) | Very difficult to construct and/or significant uncertainties in construction. | ___ | 1 | |
| b. Reliability of technology. | i) | Very reliable in meeting the specified process efficiencies or performance goals. | x | 3 | |
| | ii) | Somewhat reliable in meeting the specified process efficiencies or performance goals. | ___ | 2 | |
| c. Schedule of delays due to technical problems. | i) | Unlikely | x | 2 | |
| | ii) | Somewhat likely | ___ | 1 | |
| d. Need of undertaking additional remedial action, if necessary. | i) | No future remedial actions may be anticipated. | x | 2 | |
| | ii) | Some future remedial actions may be necessary. | ___ | 1 | 10 |
| **Subtotal (maximum = 10)** | | | | | |
| 2. Administrative Feasibility | | | | | |
| a. Coordination with other agencies. | i) | Minimal coordination is required. | ___ | 2 | |
| | ii) | Required coordination is normal. | x | 1 | |
| | iii) | Extensive coordination is required. | ___ | 0 | 1 |
| **Subtotal (maximum = 2)** | | | | | |

HOUDAILLE-MANZEL SITE
ALTERNATIVE 2 - CLAY CAP AND CONCRETE CAP (Continued)

**IMPLEMENTABILITY**
(Maximum Score = 15)

| Analysis Factor | | Basis for Evaluation During Preliminary Screening | | | | Score |
|---|---|---|---|---|---|---|
| 3. Availability of Services and Materials | | | | | | |
| a. Availability of prospective technologies. | i) | Are technologies under consideration generally commercially available for the site-specific application? | **Yes**<br>**No** | x<br>__ | 1<br>0 | |
| | ii) | Will more than one vendor be available to provide a competitive bid? | **Yes**<br>**No** | x<br>__ | 1<br>0 | |
| b. Availability of necessary equipment and specialists. | i) | Additional equipment and specialists may be available without significant delay. | **Yes**<br>**No** | x<br>__ | 1<br>0 | 3 |
| **Subtotal (maximum = 3)** | | | | | | |
| **TOTAL (Maximum = 15)** | | | | | | 14 |

**IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.**

HOUDAILLE-MANZEL SITE
ALTERNATIVE 3 - EXCAVATION/SOIL WASHING

**SHORT-TERM/LONG-TERM EFFECTIVENESS**
(Maximum Score = 25)

| Analysis Factor | Basis for Evaluation During Preliminary Screening | | | Score | |
|---|---|---|---|---|---|
| 1. Protection of community during remedial actions. | • Are there significant short-term risks to the community that must be addressed? **(If answer is no, go to Factor 2.)** | **Yes** | __ | 0 | |
| | | **No** | x | 4 | |
| | • Can the short-term risk be easily controlled? | **Yes** | __ | 1 | |
| | | **No** | __ | 0 | |
| | • Does the mitigative effort to control short-term risk impact the community life-style? | **Yes** | __ | 0 | |
| | | **No** | __ | 2 | 4 |
| **Subtotal (maximum = 4)** | | | | | |
| 2. Environmental Impacts | • Are there significant short-term risks to the environment that must be addressed? **(If answer is no, go to Factor 3.)** | **Yes** | __ | 0 | |
| | | **No** | x | 4 | |
| | • Are the available mitigative measures reliable to minimize potential impacts? | **Yes** | __ | 3 | |
| | | **No** | __ | 0 | 4 |
| **Subtotal (maximum = 4)** | | | | | |
| 3. Time to implement the remedy. | • What is the required time to implement the remedy? | **≤ 2 yr.** | x | 1 | |
| | | **> 2 yr.** | __ | 0 | |
| | • Required duration of the mitigative effort to control short-term risk. | **≤ 2 yr.** | x | 1 | |
| | | **> 2 yr.** | __ | 0 | 2 |
| **Subtotal (maximum = 2)** | | | | | |
| 4. On-site or off-site treatment or land disposal. | • On-site treatment* | | x | 3 | |
| | • Off-site treatment* | | __ | 1 | |
| | • On-site or off-site land disposal | | __ | 0 | 3 |
| **Subtotal (maximum = 3)** | | | | | |

* treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes

HOUDAILLE-MANZEL SITE
ALTERNATIVE 3 - EXCAVATION/SOIL WASHING (Continued)

## SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

| Analysis Factor | | Basis for Evaluation During Preliminary Screening | | | | Score |
|---|---|---|---|---|---|---|
| 5. Permanence of the remedial alternative. | • | Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 7.)** | **Yes** | x | 3 | |
| | | | **No** | | 0 | 3 |
| **Subtotal (maximum = 3)** | | | | | | |
| 6. Lifetime of remedial actions. | • | Expected lifetime or duration of effectiveness of the remedy. | **25-30 yr.** | | 3 | |
| | | | **20-25 yr.** | | 2 | |
| | | | **15-20 yr.** | | 1 | |
| | | | **< 15 yr.** | | 0 | |
| **Subtotal (maximum = 3)** | | | | | | |
| 7. Quantity and nature of waste or residual left at the site after remediation. | i) | Quantity of untreated hazardous waste left at the site. | **None** | x | 3 | |
| | | | **≤ 25%** | | 2 | |
| | | | **25-50%** | | 1 | |
| | | | **≥ 50%** | | 0 | |
| | ii) | Is there treated residual left at the site? **(If answer is no, go to Factor 8.)** | **Yes** | x | 0 | |
| | | | **No** | | 2 | |
| | iii) | Is the treated residual toxic? | **Yes** | | 0 | |
| | | | **No** | x | 1 | |
| | iv) | Is the treated residual mobile? | **Yes** | | 0 | |
| | | | **No** | x | 1 | 5 |
| **Subtotal (maximum = 5)** | | | | | | |

## SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

| Analysis Factor | | Basis for Evaluation During Preliminary Screening | | | Score |
|---|---|---|---|---|---|
| 8. Adequacy and reliability of controls. | i) | Operation and maintenance required for a period of: | **< 5 yr.** | x | 1 |
| | | | **> 5 yr.** | __ | 0 |
| | ii) | Are environmental controls required as a part of the remedy to handle potential problems? **(If answer is no go to "iv".)** | **Yes** | x | 0 |
| | | | **No** | __ | 1 |
| | iii) | Degree of confidence that controls can adequately handle potential problems. | **Moderate to very confident** | x | 1 |
| | | | **Somewhat to not confident** | __ | 0 |
| | iv) | Relative degree of long-term monitoring required **(compare with other remedial alternatives.)** | **Minimum** | x | 2 |
| | | | **Moderate** | __ | 1 |
| | | | **Extensive** | __ | 0 |
| **Subtotal (maximum = 4)** | | | | | 4 |
| **TOTAL (Maximum = 25)** | | | | | 25 |

**IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.**

HOUDAILLE-MANZEL SITE
ALTERNATIVE 3 - EXCAVATION/SOIL WASHING (Continued)

**IMPLEMENTABILITY**
(Maximum Score = 15)

| Analysis Factor | | Basis for Evaluation During Preliminary Screening | | Score | |
|---|---|---|---|---|---|
| 1. Technical Feasibility | | | | | |
| a. Ability to construct technology. | i) | Not difficult to construct. No uncertainties in construction. | ___ | 3 | |
| | ii) | Somewhat difficult to construct. No uncertainties in construction. | ___ | 2 | |
| | iii) | Very difficult to construct and/or significant uncertainties in construction. | x | 1 | |
| b. Reliability of technology. | i) | Very reliable in meeting the specified process efficiencies or performance goals. | ___ | 3 | |
| | ii) | Somewhat reliable in meeting the specified process efficiencies or performance goals. | x | 2 | |
| c. Schedule of delays due to technical problems. | i) | Unlikely | ___ | 2 | |
| | ii) | Somewhat likely | x | 1 | |
| d. Need of undertaking additional remedial action, if necessary. | i) | No future remedial actions may be anticipated. | x | 2 | |
| | ii) | Some future remedial actions may be necessary. | ___ | 1 | 6 |
| **Subtotal (maximum = 10)** | | | | | |
| 2. Administrative Feasibility | | | | | |
| a. Coordination with other agencies. | i) | Minimal coordination is required. | ___ | 2 | |
| | ii) | Required coordination is normal. | ___ | 1 | |
| | iii) | Extensive coordination is required (InnovativeTechnology). | x | 0 | 0 |
| **Subtotal (maximum = 2)** | | | | | |

DJE/SY117.04/0114

HOUDAILLE-MANZEL SITE
ALTERNATIVE 3 - EXCAVATION/SOIL WASHING (Continued)

**IMPLEMENTABILITY**
(Maximum Score = 15)

| Analysis Factor | | Basis for Evaluation During Preliminary Screening | | | | Score |
|---|---|---|---|---|---|---|
| 3. Availability of Services and Materials | | | | | | |
| a. Availability of prospective technologies. | i) | Are technologies under consideration generally commercially available for the site-specific application? | Yes<br>No | _<br>x | 1<br>0 | |
| | ii) | Will more than one vendor be available to provide a competitive bid? | Yes<br>No | x<br>_ | 1<br>0 | |
| b. Availability of necessary equipment and specialists. | i) | Additional equipment and specialists may be available without significant delay. | Yes<br>No | _<br>x | 1<br>0 | |
| **Subtotal (maximum = 3)** | | | | | | 1 |
| **TOTAL (Maximum = 15)** | | | | | | 7 |

**IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.**

DJE/SY117.04/0114

HOUDAILLE-MANZEL SITE
ALTERNATIVE 4 - EXCAVATION (>500 PPM LEAD)/OFF-SITE LANDFILLING

**SHORT-TERM/LONG-TERM EFFECTIVENESS**
(Maximum Score = 25)

| Analysis Factor | Basis for Evaluation During Preliminary Screening | | | | Score |
|---|---|---|---|---|---|
| 1. Protection of community during remedial actions. | • Are there significant short-term risks to the community that must be addressed? **(If answer is no, go to Factor 2.)** | **Yes** | __ | 0 | |
| | | **No** | x | 4 | |
| | • Can the short-term risk be easily controlled? | **Yes** | __ | 1 | |
| | | **No** | __ | 0 | |
| | • Does the mitigative effort to control short-term risk impact the community life-style? | **Yes** | __ | 0 | |
| | | **No** | __ | 2 | |
| **Subtotal (maximum = 4)** | | | | | 4 |
| 2. Environmental Impacts | • Are there significant short-term risks to the environment that must be addressed? **(If answer is no, go to Factor 3.)** | **Yes** | __ | 0 | |
| | | **No** | x | 4 | |
| | • Are the available mitigative measures reliable to minimize potential impacts? | **Yes** | __ | 3 | |
| | | **No** | __ | 0 | |
| **Subtotal (maximum = 4)** | | | | | 4 |
| 3. Time to implement the remedy. | • What is the required time to implement the remedy? | **≤ 2 yr.** | x | 1 | |
| | | **> 2 yr.** | __ | 0 | |
| | • Required duration of the mitigative effort to control short-term risk. | **≤ 2 yr.** | x | 1 | |
| | | **> 2 yr.** | __ | 0 | |
| **Subtotal (maximum = 2)** | | | | | 2 |
| 4. On-site or off-site treatment or land disposal. | • On-site treatment* | | __ | 3 | |
| | • Off-site treatment* | | __ | 1 | |
| | • On-site or off-site land disposal | | x | 0 | |
| **Subtotal (maximum = 3)** | | | | | 0 |

* treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes

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HOUDAILLE-MANZEL SITE
ALTERNATIVE 4 - EXCAVATION (>500 PPM LEAD)/OFF-SITE LANDFILLING (Continued)

**SHORT-TERM/LONG-TERM EFFECTIVENESS**
(Maximum Score = 25)

| Analysis Factor | | Basis for Evaluation During Preliminary Screening | | | Score | |
|---|---|---|---|---|---|---|
| 5. Permanence of the remedial alternative. | • | Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 7.)** | **Yes** | x | 3 | |
| | | | **No** | __ | 0 | |
| | | | | | | 3 |
| **Subtotal (maximum = 3)** | | | | | | |
| 6. Lifetime of remedial actions. | • | Expected lifetime or duration of effectiveness of the remedy. | **25-30 yr.** | __ | 3 | |
| | | | **20-25 yr.** | __ | 2 | |
| | | | **15-20 yr.** | __ | 1 | |
| | | | **< 15 yr.** | __ | 0 | __ |
| **Subtotal (maximum = 3)** | | | | | | |
| 7. Quantity and nature of waste or residual left at the site after remediation. | i) | Quantity of untreated hazardous waste left at the site. | **None** | x | 3 | |
| | | | **≤ 25%** | __ | 2 | |
| | | | **25-50%** | __ | 1 | |
| | | | **≥ 50%** | __ | 0 | |
| | ii) | Is there treated residual left at the site? **(If answer is no, go to Factor 8.)** | **Yes** | __ | 0 | |
| | | | **No** | x | 2 | |
| | iii) | Is the treated residual toxic? | **Yes** | __ | 0 | |
| | | | **No** | __ | 1 | |
| | iv) | Is the treated residual mobile? | **Yes** | __ | 0 | |
| | | | **No** | __ | 1 | |
| | | | | | | 5 |
| **Subtotal (maximum = 5)** | | | | | | |

HOUDAILLE-MANZEL SITE
ALTERNATIVE 4 - EXCAVATION (>500 PPM LEAD)/OFF-SITE LANDFILLING (Continued)

**SHORT-TERM/LONG-TERM EFFECTIVENESS**
(Maximum Score = 25)

| Analysis Factor | | Basis for Evaluation During Preliminary Screening | | | Score |
|---|---|---|---|---|---|
| 8. Adequacy and reliability of controls. | i) | Operation and maintenance required for a period of: | **< 5 yr.** | x | 1 |
| | | | **> 5 yr.** | __ | 0 |
| | ii) | Are environmental controls required as a part of the remedy to handle potential problems? **(If answer is no go to "iv".)** | **Yes** | x | 0 |
| | | | **No** | __ | 1 |
| | iii) | Degree of confidence that controls can adequately handle potential problems. | **Moderate to very confident** | x | 1 |
| | | | **Somewhat to not confident** | __ | 0 |
| | iv) | Relative degree of long-term monitoring required **(compare with other remedial alternatives.)** | **Minimum** | x | 2 |
| | | | **Moderate** | __ | 1 |
| | | | **Extensive** | __ | 0 |
| **Subtotal (maximum = 4)** | | | | | 4 |
| **TOTAL (Maximum = 25)** | | | | | 23 |

**IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.**

HOUDAILLE-MANZEL SITE

ALTERNATIVE 4 - EXCAVATION (>500 PPM LEAD)/OFF-SITE LANDFILLING (Continued)

**IMPLEMENTABILITY**

(Maximum Score = 15)

| Analysis Factor | | Basis for Evaluation During Preliminary Screening | | Score | |
|---|---|---|---|---|---|
| 1. Technical Feasibility | | | | | |
| a. Ability to construct technology. | i) | Not difficult to construct. No uncertainties in construction. | x | 3 | |
| | ii) | Somewhat difficult to construct. No uncertainties in construction. | ___ | 2 | |
| | iii) | Very difficult to construct and/or significant uncertainties in construction. | ___ | 1 | |
| b. Reliability of technology. | i) | Very reliable in meeting the specified process efficiencies or performance goals. | x | 3 | |
| | ii) | Somewhat reliable in meeting the specified process efficiencies or performance goals. | ___ | 2 | |
| c. Schedule of delays due to technical problems. | i) | Unlikely | x | 2 | |
| | ii) | Somewhat likely | ___ | 1 | |
| d. Need of undertaking additional remedial action, if necessary. | i) | No future remedial actions may be anticipated. | x | 2 | |
| | ii) | Some future remedial actions may be necessary. | ___ | 1 | 10 |
| **Subtotal (maximum = 10)** | | | | | |
| 2. Administrative Feasibility | | | | | |
| a. Coordination with other agencies. | i) | Minimal coordination is required. | ___ | 2 | |
| | ii) | Required coordination is normal. | x | 1 | |
| | iii) | Extensive coordination is required. | ___ | 0 | 1 |
| **Subtotal (maximum = 2)** | | | | | |

HOUDAILLE-MANZEL SITE
ALTERNATIVE 4 - EXCAVATION (>500 PPM LEAD)/OFF-SITE LANDFILLING (Continued)

## IMPLEMENTABILITY
(Maximum Score = 15)

| Analysis Factor | | Basis for Evaluation During Preliminary Screening | | | | Score |
|---|---|---|---|---|---|---|
| 3. <u>Availability of Services and Materials</u> | | | | | | |
| a. Availability of prospective technologies. | i) | Are technologies under consideration generally commercially available for the site-specific application? | **Yes**<br>**No** | x<br>__ | 1<br>0 | |
| | ii) | Will more than one vendor be available to provide a competitive bid? | **Yes**<br>**No** | x<br>__ | 1<br>0 | |
| b. Availability of necessary equipment and specialists. | i) | Additional equipment and specialists may be available without significant delay. | **Yes**<br>**No** | x<br>__ | 1<br>0 | 3 |
| **Subtotal (maximum = 3)** | | | | | | |
| **TOTAL (Maximum = 15)** | | | | | | 14 |

**IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.**

HOUDAILLE-MANZEL SITE
ALTERNATIVE 5 - EXCAVATION OF HOT-SPOT/OFF-SITE LANDFILLING/BASIC SOIL AND CONCRETE CAP

## SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

| Analysis Factor | Basis for Evaluation During Preliminary Screening | | | Score | |
|---|---|---|---|---|---|
| 1. Protection of community during remedial actions. | • Are there significant short-term risks to the community that must be addressed? **(If answer is no, go to Factor 2.)** | **Yes**<br>**No** | __<br>x | 0<br>4 | |
| | • Can the short-term risk be easily controlled? | **Yes**<br>**No** | __<br>__ | 1<br>0 | |
| | • Does the mitigative effort to control short-term risk impact the community life-style? | **Yes**<br>**No** | __<br>__ | 0<br>2 | 4 |
| **Subtotal (maximum = 4)** | | | | | |
| 2. Environmental Impacts | • Are there significant short-term risks to the environment that must be addressed? **(If answer is no, go to Factor 3.)** | **Yes**<br>**No** | __<br>x | 0<br>4 | |
| | • Are the available mitigative measures reliable to minimize potential impacts? | **Yes**<br>**No** | __<br>__ | 3<br>0 | 4 |
| **Subtotal (maximum = 4)** | | | | | |
| 3. Time to implement the remedy. | • What is the required time to implement the remedy? | **≤ 2 yr.**<br>**> 2 yr.** | x<br>__ | 1<br>0 | |
| | • Required duration of the mitigative effort to control short-term risk. | **≤ 2 yr.**<br>**> 2 yr.** | x<br>__ | 1<br>0 | 2 |
| **Subtotal (maximum = 2)** | | | | | |
| 4. On-site or off-site treatment or land disposal. | • On-site treatment* | | __ | 3 | |
| | • Off-site treatment* | | __ | 1 | |
| | • On-site or off-site land disposal | | x | 0 | 0 |
| **Subtotal (maximum = 3)** | | | | | |

* treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes

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HOUDAILLE-MANZEL SITE
ALTERNATIVE 5 - EXCAVATION OF HOT-SPOT/OFF-SITE LANDFILLING/BASIC SOIL AND CONCRETE CAP (Continued)

**SHORT-TERM/LONG-TERM EFFECTIVENESS**
(Maximum Score = 25)

| Analysis Factor | | Basis for Evaluation During Preliminary Screening | | | | Score |
|---|---|---|---|---|---|---|
| 5. Permanence of the remedial alternative. | • | Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 7.)** | **Yes** | __ | 3 | |
| | | | **No** | x | 0 | 0 |
| **Subtotal (maximum = 3)** | | | | | | |
| 6. Lifetime of remedial actions. | • | Expected lifetime or duration of effectiveness of the remedy. | **25-30 yr.** | x | 3 | |
| | | | **20-25 yr.** | __ | 2 | |
| | | | **15-20 yr.** | __ | 1 | |
| | | | **< 15 yr.** | __ | 0 | 3 |
| **Subtotal (maximum = 3)** | | | | | | |
| 7. Quantity and nature of waste or residual left at the site after remediation. | i) | Quantity of untreated hazardous waste left at the site. | **None** | x | 3 | |
| | | | **≤ 25%** | __ | 2 | |
| | | | **25-50%** | __ | 1 | |
| | | | **≥ 50%** | __ | 0 | |
| | ii) | Is there treated residual left at the site? **(If answer is no, go to Factor 8.)** | **Yes** | __ | 0 | |
| | | | **No** | x | 2 | |
| | iii) | Is the treated residual toxic? | **Yes** | __ | 0 | |
| | | | **No** | __ | 1 | |
| | iv) | Is the treated residual mobile? | **Yes** | __ | 0 | |
| | | | **No** | __ | 1 | 5 |
| **Subtotal (maximum = 5)** | | | | | | |

HOUDAILLE-MANZEL SITE
ALTERNATIVE 5 - EXCAVATION OF HOT-SPOT/OFF-SITE LANDFILLING/BASIC SOIL AND CONCRETE CAP (Continued)

**SHORT-TERM/LONG-TERM EFFECTIVENESS**
(Maximum Score = 25)

| Analysis Factor | | Basis for Evaluation During Preliminary Screening | | | Score |
|---|---|---|---|---|---|
| 8. Adequacy and reliability of controls. | i) | Operation and maintenance required for a period of: | **< 5 yr.** | x | 1 |
| | | | **> 5 yr.** | | 0 |
| | ii) | Are environmental controls required as a part of the remedy to handle potential problems? **(If answer is no go to "iv".)** | **Yes** | x | 0 |
| | | | **No** | | 1 |
| | iii) | Degree of confidence that controls can adequately handle potential problems. | **Moderate to very confident** | x | 1 |
| | | | **Somewhat to not confident** | | 0 |
| | iv) | Relative degree of long-term monitoring required **(compare with other remedial alternatives.)** | **Minimum** | x | 2 |
| | | | **Moderate** | | 1 |
| | | | **Extensive** | | 0 |
| **Subtotal (maximum = 4)** | | | | | 4 |
| **TOTAL (Maximum = 25)** | | | | | 22 |

**IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.**

## IMPLEMENTABILITY
(Maximum Score = 15)

| Analysis Factor | | Basis for Evaluation During Preliminary Screening | | Score | |
|---|---|---|---|---|---|
| 1. Technical Feasibility | | | | | |
| a. Ability to construct technology. | i) | Not difficult to construct. No uncertainties in construction. | x | 3 | |
| | ii) | Somewhat difficult to construct. No uncertainties in construction. | | 2 | |
| | iii) | Very difficult to construct and/or significant uncertainties in construction. | | 1 | |
| b. Reliability of technology. | i) | Very reliable in meeting the specified process efficiencies or performance goals. | x | 3 | |
| | ii) | Somewhat reliable in meeting the specified process efficiencies or performance goals. | | 2 | |
| c. Schedule of delays due to technical problems. | i) | Unlikely | x | 2 | |
| | ii) | Somewhat likely | | 1 | |
| d. Need of undertaking additional remedial action, if necessary. | i) | No future remedial actions may be anticipated. | x | 2 | |
| | ii) | Some future remedial actions may be necessary. | | 1 | 10 |
| **Subtotal (maximum = 10)** | | | | | |
| 2. Administrative Feasibility | | | | | |
| a. Coordination with other agencies. | i) | Minimal coordination is required. | | 2 | |
| | ii) | Required coordination is normal. | x | 1 | |
| | iii) | Extensive coordination is required. | | 0 | 1 |
| **Subtotal (maximum = 2)** | | | | | |

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HOUDAILLE-MANZEL SITE
ALTERNATIVE 5 - EXCAVATION OF HOT-SPOT/OFF-SITE LANDFILLING/BASIC SOIL AND CONCRETE CAP (Continued)

**IMPLEMENTABILITY**
(Maximum Score = 15)

| Analysis Factor | | Basis for Evaluation During Preliminary Screening | | | Score |
|---|---|---|---|---|---|
| 3. Availability of Services and Materials | | | | | |
| a. Availability of prospective technologies. | i) | Are technologies under consideration generally commercially available for the site-specific application? | **Yes**<br>**No** | x<br>__ | 1<br>0 |
| | ii) | Will more than one vendor be available to provide a competitive bid? | **Yes**<br>**No** | x<br>__ | 1<br>0 |
| b. Availability of necessary equipment and specialists. | i) | Additional equipment and specialists may be available without significant delay. | **Yes**<br>**No** | x<br>__ | 1<br>0 |
| **Subtotal (maximum = 3)** | | | | | 3 |
| **TOTAL (Maximum = 15)** | | | | | 14 |

**IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.**

# APPENDIX J

# TAGM TABLES FOR DETAILED ANALYSIS

HOUDAILLE-MANZEL SITE
ALTERNATIVE 1 - NO ACTION WITH LONG TERM MONITORING

**COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)**
(Relative Weight = 10)

| Analysis Factor | Basis for Evaluation During Detailed Analysis | | | Score |
|---|---|---|---|---|
| 1. Compliance with chemical-specific SCGs. | Meets chemical specific SCGs such as groundwater standards. | **Yes** | x | 4 |
| | | **No** | ___ | 0 |
| 2. Compliance with action-specific SCGs. | Meets SCGs such as technology standards for incineration or landfill. | **Yes** | x | 3 |
| | | **No** | ___ | 0 |
| 3. Compliance with location-specific SCGs. | Meets location-specific SCGS such as Freshwater Wetlands Act. | **Yes** | x | 3 |
| | | **No** | ___ | 0 |
| **TOTAL (maximum = 10)** | | | | **10** |

HOUDAILLE-MANZEL SITE
ALTERNATIVE 1 - NO ACTION WITH LONG TERM MONITORING (Continued)

**PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT**
(Relative Weight = 20)

| Analysis Factor | | Basis for Evaluation During Detailed Analysis | | | Score | |
|---|---|---|---|---|---|---|
| 1. Use of the site after remediation. | | Unrestricted use of the land and water. **(If answer is yes, go to the end of the Table.)** | Yes<br>No | ___<br>x | 20<br>0 | 0 |
| **TOTAL (maximum = 20)** | | | | | | |
| 2. Human health and the environment exposure after the remediation. | i) | Is the exposure to contaminants via air route acceptable? | Yes<br>No | x<br>___ | 3<br>0 | |
| | ii) | Is the exposure to contaminants via groundwater/surface water acceptable? | Yes<br>No | x<br>___ | 4<br>0 | |
| | iii) | Is the exposure to contaminants via sediments/soils acceptable? | Yes<br>No | x<br>___ | 3<br>0 | 10 |
| **Subtotal (maximum = 10)** | | | | | | |
| 3. Magnitude of residual public health risks after the remediation. | i) | Health risk | ≤ 1 in 1,000,000 | x | 5 | |
| | ii) | Health risk | ≤ 1 in 100,000 | ___ | 2 | 5 |
| **Subtotal (maximum = 5)** | | | | | | |
| 4. Magnitude of residual environmental risks after the remediation. | i) | Less than acceptable | | x | 5 | |
| | ii) | Slightly greater than acceptable | | ___ | 3 | |
| | iii) | Significant risk still exists | | ___ | 0 | 5 |
| **Subtotal (maximum = 5)** | | | | | | |
| **TOTAL (maximum = 20)** | | | | | | 20 |

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HOUDAILLE-MANZEL SITE
ALTERNATIVE 1 - NO ACTION WITH LONG TERM MONITORING (Continued)

## SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

| Analysis Factor | Basis for Evaluation During Detailed Analysis | | | Score | |
|---|---|---|---|---|---|
| 1. Protection of community during remedial actions. | • Are there significant short-term risks to the community that must be addressed? **(If answer is no, go to Factor 2.)** | **Yes**<br>**No** | __<br>x | 0<br>4 | |
| | • Can the risk be easily controlled? | **Yes**<br>**No** | __<br>__ | 1<br>0 | |
| | • Does the mitigative effort to control risk impact the community lifestyle? | **Yes**<br>**No** | __<br>__ | 0<br>2 | 4 |
| **Subtotal (maximum = 4)** | | | | | |
| 2. Environmental Impacts | • Are there significant short-term risks to the environment that must be addressed? **(If answer is no, go to Factor 3.)** | **Yes**<br>**No** | __<br>x | 0<br>4 | |
| | • Are the available mitigative measures reliable to minimize potential impacts? | **Yes**<br>**No** | __<br>__ | 3<br>0 | 4 |
| **Subtotal (maximum = 4)** | | | | | |
| 3. Time to implement the remedy. | • What is the required time to implement the remedy? | **≤ 2 yr.**<br>**> 2 yr.** | x<br>__ | 1<br>0 | |
| | • Required duration of the mitigative effort to control short-term risk. | **≤ 2 yr.**<br>**> 2 yr.** | x<br>__ | 1<br>0 | 2 |
| **Subtotal (maximum = 2)** | | | | | |
| **TOTAL (maximum = 10)** | | | | | 10 |

HOUDAILLE-MANZEL SITE
ALTERNATIVE 1 - NO ACTION WITH LONG TERM MONITORING (Continued)

**LONG-TERM EFFECTIVENESS AND PERMANENCE**
(Relative Weight = 15)

| Analysis Factor | | Basis for Evaluation During Detailed Analysis | | | Score | |
|---|---|---|---|---|---|---|
| 1. On-site or off-site treatment or land disposal | • | On-site treatment* | | __ | 3 | |
| | • | Off-site treatment* | | __ | 1 | |
| | • | On-site or off-site land disposal | | x | 0 | 0 |
| **Subtotal (maximum = 3)** | | | | | | |
| * treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes | | | | | | |
| 2. Permanence of the remedial alternative. | • | Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 4.)** | **Yes** | __ | 3 | |
| | | | **No** | x | 0 | 0 |
| **Subtotal (maximum = 3)** | | | | | | |
| 3. Lifetime of remedial actions. | • | Expected lifetime or duration of effectiveness of the remedy. | **25-30 yr.** | x | 3 | |
| | | | **20-25 yr.** | __ | 2 | |
| | | | **15-20 yr.** | __ | 1 | |
| | | | **< 15 yr.** | __ | 0 | 3 |
| **Subtotal (maximum = 3)** | | | | | | |
| 4. Quantity and nature of waste or residual left at the site after remediation. | i) | Quantity of untreated hazardous waste left at the site. | **None** | x | 3 | |
| | | | **< 25%** | __ | 2 | |
| | | | **25-50%** | __ | 1 | |
| | | | **> 50%** | __ | 0 | |
| | ii) | Is there treated residual left at the site? **(If answer is no, go to Factor 5.)** | **Yes** | __ | 0 | |
| | | | **No** | x | 2 | |
| | iii) | Is the treated residual toxic | **Yes** | __ | 0 | |
| | | | **No** | __ | 1 | |
| | iv) | Is the treated residual mobile? | **Yes** | __ | 0 | |
| | | | **No** | __ | 1 | 5 |
| **Subtotal (maximum = 5)** | | | | | | |

HOUDAILLE-MANZEL SITE
ALTERNATIVE 1 - NO ACTION WITH LONG TERM MONITORING (Continued)

**LONG-TERM EFFECTIVENESS AND PERMANENCE, CONTINUED**
(Relative Weight = 15)

| Analysis Factor | | Basis for Evaluation During Detailed Analysis | | | Score |
|---|---|---|---|---|---|
| 5. Adequacy and reliability of controls. | i) | Operation and maintenance required for a period of: | **< 5 yr.** | x | 1 |
| | | | **> 5 yr.** | __ | 0 |
| | ii) | Are environmental controls required as a part of the remedy to handle potential problems? **(If answer is no, go to "iv")** | **Yes** | __ | 0 |
| | | | **No** | x | 1 |
| | iii) | Degree of confidence that controls can adequately handle potential problems. | **Moderate to very confident** | __ | 1 |
| | | | **Somewhat to not confident** | __ | 0 |
| | iv) | Relative degree of long-term monitoring required **(compare with other remedial alternatives** | **Minimum** | x | 2 |
| | | | **Moderate** | __ | 1 |
| | | | **Extensive** | __ | 0 |
| | | | | | 4 |
| **Subtotal (maximum = 4)** | | | | | |
| **TOTAL (maximum = 15)** | | | | | 12 |

## REDUCTION OF TOXICITY, MOBILITY OR VOLUME

(Relative Weight = 15)

| Analysis Factor | | Basis for Evaluation During Detailed Analysis | | | Score | |
|---|---|---|---|---|---|---|
| 1. Volume of hazardous waste reduced (Reduction in volume or toxicity). **If Factor 1 is not applicable, go to Factor 2.** | i) | Quantity of hazardous waste destroyed or treated. **Immobilization technologies do not score under Factor 1.** | **99-100%** | __ | 8 | |
| | | | **90-99%** | __ | 7 | |
| | | | **80-90%** | __ | 6 | |
| | | | **60-80%** | __ | 4 | |
| | | | **40-60%** | __ | 2 | |
| | | | **20-40%** | __ | 1 | |
| | | | **< 20%** | __ | 0 | |
| | ii) | Are there untreated or concentrated hazardous waste produced as a result of (i)? **If answer is no, go to Factor 2.** | **Yes** | __ | 0 | |
| | | | **No** | __ | 2 | |
| **Subtotal (maximum = 10) (If subtotal = 10, go to Factor 3)** | iii) | After remediation, how is the untreated, residual hazardous waste material disposed? | **Off-site land disposal** | __ | 0 | |
| | | | **On-site land disposal** | __ | 1 | |
| | | | **Offsite destruction or treatment** | __ | 2 | 0 |
| 2. Reduction in mobility of hazardous waste. **If Factor 2 is not applicable, go to Factor 3.** | i) | <u>Quantity of Available Wastes Immobilized After Destruction/ Treatment</u> | **90-100%** | __ | 2 | |
| | | | **60-90%** | __ | 1 | |
| | | | **< 60%** | x | 0 | |
| | ii) | <u>Method of Immobilization</u> | | | | |
| | | - Reduced mobility by containment | | x | 0 | |
| **Subtotal (maximum = 5)** | | - Reduced mobility by alternative treatment technologies | | __ | 3 | 0 |
| 3. Irreversibility of the destruction or treatment of hazardous waste. | i) | Completely irreversible | | __ | 5 | |
| | ii) | Irreversible for most of the hazardous waste constituents. | | __ | 3 | |
| | iii) | Irreversible for only some of the hazardous waste constituents. | | __ | 2 | |
| | iv) | Reversible for most of the hazardous waste constituents. | | __ | 0 | |
| **Subtotal (maximum = 5)** | | | | | | 0 |
| **TOTAL (maximum = 15)** | | | | | | 0 |

HOUDAILLE-MANZEL SITE
ALTERNATIVE 1 - NO ACTION WITH LONG TERM MONITORING (Continued)

**IMPLEMENTABILITY**
(Relative Weight = 15)

| Analysis Factor | | Basis for Evaluation During Detailed Analysis | | Score | |
|---|---|---|---|---|---|
| 1. Technical Feasibility | | | | | |
| a. Ability to construct technology. | i) | Not difficult to construct. No uncertainties in construction. | x | 3 | |
| | ii) | Somewhat difficult to construct. No uncertainties in construction. | ___ | 2 | |
| | iii) | Very difficult to construct and/or significant uncertainties in construction. | ___ | 1 | |
| b. Reliability of technology. | i) | Very reliable in meeting the specified process efficiencies or performance goals. | x | 3 | |
| | ii) | Somewhat reliable in meeting the specified process efficiencies or performance goals. | ___ | 2 | |
| c. Schedule of delays due to technical problems. | i) | Unlikely | x | 2 | |
| | ii) | Somewhat unlikely | ___ | 1 | |
| d. Need of undertaking additional remedial action, if necessary. | i) | No future remedial actions may be anticipated. | x | 2 | |
| | ii) | Some future remedial actions may be necessary. | ___ | 1 | 10 |
| **Subtotal (maximum = 10)** | | | | | |
| 2. Administrative Feasibility | | | | | |
| a. Coordination with other agencies. | i) | Minimal coordination is required. | x | 2 | |
| | ii) | Required coordination is normal. | ___ | 1 | |
| | iii) | Extensive coordination is required. | ___ | 0 | 2 |
| **Subtotal (maximum = 2)** | | | | | |

HOUDAILLE-MANZEL SITE
ALTERNATIVE 1 - NO ACTION WITH LONG TERM MONITORING (Continued)

**IMPLEMENTABILITY (CONTINUED)**
(Relative Weight = 15)

| Analysis Factor | | Basis for Evaluation During Detailed Analysis | | | Score |
|---|---|---|---|---|---|
| 3. Availability of Services and Materials | | | | | |
| a. Availability of prospective technologies. | i) | Are technologies under consideration generally commercially available for the site-specific application? | **Yes**<br>**No** | x<br>__ | 1<br>0 |
| | ii) | Will more than one vendor be available to provide a competitive bid? | **Yes**<br>**No** | x<br>__ | 1<br>0 |
| b. Availability of necessary equipment and specialists. | i) | Additional equipment and specialists may be available without significant delay. | **Yes**<br>**No** | x<br>__ | 1<br>0 |
| **Subtotal (maximum = 3)** | | | | | 3 |
| **TOTAL (maximum = 15)** | | | | | 15 |

HOUDAILLE-MANZEL SITE
ALTERNATIVE 2 - CLAY CAP AND CONCRETE CAP

## COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)

(Relative Weight = 10)

| Analysis Factor | Basis for Evaluation During Detailed Analysis | | | Score |
|---|---|---|---|---|
| 1. Compliance with chemical-specific SCGs. | Meets chemical specific SCGs such as groundwater standards. | **Yes** | x | 4 |
| | | **No** | ___ | 0 |
| 2. Compliance with action-specific SCGs. | Meets SCGs such as technology standards for incineration or landfill. | **Yes** | x | 3 |
| | | **No** | ___ | 0 |
| 3. Compliance with location-specific SCGs. | Meets location-specific SCGS such as Freshwater Wetlands Act. | **Yes** | x | 3 |
| | | **No** | ___ | 0 |
| **TOTAL (maximum = 10)** | | | | 10 |

HOUDAILLE-MANZEL SITE
ALTERNATIVE 2 - CLAY CAP AND CONCRETE CAP (Continued)

## PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

| Analysis Factor | | Basis for Evaluation During Detailed Analysis | | | Score | |
|---|---|---|---|---|---|---|
| 1. Use of the site after remediation. | | Unrestricted use of the land and water. **(If answer is yes, go to the end of the Table.)** | **Yes** | ___ | 20 | |
| | | | **No** | x | 0 | 0 |
| **TOTAL (maximum = 20)** | | | | | | |
| 2. Human health and the environment exposure after the remediation. | i) | Is the exposure to contaminants via air route acceptable? | **Yes** | x | 3 | |
| | | | **No** | ___ | 0 | |
| | ii) | Is the exposure to contaminants via groundwater/surface water acceptable? | **Yes** | x | 4 | |
| | | | **No** | ___ | 0 | |
| | iii) | Is the exposure to contaminants via sediments/soils acceptable? | **Yes** | x | 3 | |
| | | | **No** | ___ | 0 | 10 |
| **Subtotal (maximum = 10)** | | | | | | |
| 3. Magnitude of residual public health risks after the remediation. | i) | Health risk | ≤ 1 in 1,000,000 | x | 5 | |
| | ii) | Health risk | ≤ 1 in 100,000 | ___ | 2 | 5 |
| **Subtotal (maximum = 5)** | | | | | | |
| 4. Magnitude of residual environmental risks after the remediation. | i) | Less than acceptable | | x | 5 | |
| | ii) | Slightly greater than acceptable | | ___ | 3 | |
| | iii) | Significant risk still exists | | ___ | 0 | 5 |
| **Subtotal (maximum = 5)** | | | | | | |
| **TOTAL (maximum = 20)** | | | | | | 20 |

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HOUDAILLE-MANZEL SITE
ALTERNATIVE 2 - CLAY CAP AND CONCRETE CAP (Continued)

## SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

| Analysis Factor | Basis for Evaluation During Detailed Analysis | | | Score | |
|---|---|---|---|---|---|
| 1. Protection of community during remedial actions. | • Are there significant short-term risks to the community that must be addressed? **(If answer is no, go to Factor 2.)** | **Yes** | ___ | 0 | |
| | | **No** | x | 4 | |
| | • Can the risk be easily controlled? | **Yes** | ___ | 1 | |
| | | **No** | ___ | 0 | |
| | • Does the mitigative effort to control risk impact the community lifestyle? | **Yes** | ___ | 0 | |
| | | **No** | ___ | 2 | |
| **Subtotal (maximum = 4)** | | | | | 4 |
| 2. Environmental Impacts | • Are there significant short-term risks to the environment that must be addressed? **(If answer is no, go to Factor 3.)** | **Yes** | ___ | 0 | |
| | | **No** | x | 4 | |
| | • Are the available mitigative measures reliable to minimize potential impacts? | **Yes** | ___ | 3 | |
| | | **No** | ___ | 0 | |
| **Subtotal (maximum = 4)** | | | | | 4 |
| 3. Time to implement the remedy. | • What is the required time to implement the remedy? | **≤ 2 yr.** | x | 1 | |
| | | **> 2 yr.** | ___ | 0 | |
| | • Required duration of the mitigative effort to control short-term risk. | **≤ 2 yr.** | x | 1 | |
| | | **> 2 yr.** | ___ | 0 | |
| **Subtotal (maximum = 2)** | | | | | 2 |
| **TOTAL (maximum = 10)** | | | | | 10 |

## LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

| Analysis Factor | | Basis for Evaluation During Detailed Analysis | | | Score | |
|---|---|---|---|---|---|---|
| 1. On-site or off-site treatment or land disposal | • | On-site treatment* | | __ | 3 | |
| | • | Off-site treatment* | | __ | 1 | |
| | • | On-site or off-site land disposal | | x | 0 | |
| **Subtotal (maximum = 3)** | | | | | | 0 |
| * treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes | | | | | | |
| 2. Permanence of the remedial alternative. | • | Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 4.)** | **Yes** | __ | 3 | |
| | | | **No** | x | 0 | |
| **Subtotal (maximum = 3)** | | | | | | 0 |
| 3. Lifetime of remedial actions. | • | Expected lifetime or duration of effectiveness of the remedy. | **25-30 yr.** | x | 3 | |
| | | | **20-25 yr.** | __ | 2 | |
| | | | **15-20 yr.** | __ | 1 | |
| | | | **< 15 yr.** | __ | 0 | |
| **Subtotal (maximum = 3)** | | | | | | 3 |
| 4. Quantity and nature of waste or residual left at the site after remediation. | i) | Quantity of untreated hazardous waste left at the site. | **None** | x | 3 | |
| | | | **< 25%** | __ | 2 | |
| | | | **25-50%** | __ | 1 | |
| | | | **> 50%** | __ | 0 | |
| | ii) | Is there treated residual left at the site? **(If answer is no, go to Factor 5.)** | **Yes** | __ | 0 | |
| | | | **No** | x | 2 | |
| | iii) | Is the treated residual toxic | **Yes** | __ | 0 | |
| | | | **No** | __ | 1 | |
| | iv) | Is the treated residual mobile? | **Yes** | __ | 0 | |
| | | | **No** | __ | 1 | |
| **Subtotal (maximum = 5)** | | | | | | 5 |

HOUDAILLE-MANZEL SITE
ALTERNATIVE 2 - CLAY CAP AND CONCRETE CAP (Continued)

**LONG-TERM EFFECTIVENESS AND PERMANENCE, CONTINUED**
(Relative Weight = 15)

| Analysis Factor | | Basis for Evaluation During Detailed Analysis | | | Score |
|---|---|---|---|---|---|
| 5. Adequacy and reliability of controls. | i) | Operation and maintenance required for a period of: | **< 5 yr.** | __ | 1 |
| | | | **> 5 yr.** | x | 0 |
| | ii) | Are environmental controls required as a part of the remedy to handle potential problems? **(If answer is no, go to "iv")** | **Yes** | x | 0 |
| | | | **No** | __ | 1 |
| | iii) | Degree of confidence that controls can adequately handle potential problems. | **Moderate to very confident** | x | 1 |
| | | | **Somewhat to not confident** | __ | 0 |
| | iv) | Relative degree of long-term monitoring required **(compare with other remedial alternatives** | **Minimum** | x | 2 |
| | | | **Moderate** | __ | 1 |
| | | | **Extensive** | __ | 0 |
| | | | | | 3 |
| **Subtotal (maximum = 4)** | | | | | |
| **TOTAL (maximum = 15)** | | | | | 11 |

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## REDUCTION OF TOXICITY, MOBILITY OR VOLUME

(Relative Weight = 15)

| Analysis Factor | | Basis for Evaluation During Detailed Analysis | | | Score | |
|---|---|---|---|---|---|---|
| 1. Volume of hazardous waste reduced (Reduction in volume or toxicity). **If Factor 1 is not applicable, go to Factor 2.** | i) | Quantity of hazardous waste destroyed or treated. **Immobilization technologies do not score under Factor 1.** | **99-100%** | ___ | 8 | |
| | | | **90-99%** | ___ | 7 | |
| | | | **80-90%** | ___ | 6 | |
| | | | **60-80%** | ___ | 4 | |
| | | | **40-60%** | ___ | 2 | |
| | | | **20-40%** | ___ | 1 | |
| | | | **< 20%** | x | 0 | |
| | ii) | Are there untreated or concentrated hazardous waste produced as a result of (i)? **If answer is no, go to Factor 2.** | **Yes** | ___ | 0 | |
| | | | **No** | ___ | 2 | |
| **Subtotal (maximum = 10) (If subtotal = 10, go to Factor 3)** | iii) | After remediation, how is the untreated, residual hazardous waste material disposed? | **Off-site land disposal** | ___ | 0 | |
| | | | **On-site land disposal** | ___ | 1 | |
| | | | **Offsite destruction or treatment** | ___ | 2 | 0 |
| 2. Reduction in mobility of hazardous waste. **If Factor 2 is not applicable, go to Factor 3.** | i) | Quantity of Available Wastes Immobilized After Destruction/ Treatment | **90-100%** | x | 2 | |
| | | | **60-90%** | ___ | 1 | |
| | | | **< 60%** | ___ | 0 | |
| | ii) | Method of Immobilization | | | | |
| | | - Reduced mobility by containment | | x | 0 | |
| **Subtotal (maximum = 5)** | | - Reduced mobility by alternative treatment technologies | | ___ | 3 | 2 |
| 3. Irreversibility of the destruction or treatment of hazardous waste. | i) | Completely irreversible | | ___ | 5 | |
| | ii) | Irreversible for most of the hazardous waste constituents. | | ___ | 3 | |
| | iii) | Irreversible for only some of the hazardous waste constituents. | | ___ | 2 | |
| | iv) | Reversible for most of the hazardous waste constituents. | | x | 0 | 0 |
| **Subtotal (maximum = 5)** | | | | | | |
| **TOTAL (maximum = 15)** | | | | | | **2** |

HOUDAILLE-MANZEL SITE
ALTERNATIVE 2 - CLAY CAP AND CONCRETE CAP (Continued)

**IMPLEMENTABILITY**
(Relative Weight = 15)

| Analysis Factor | | Basis for Evaluation During Detailed Analysis | | Score | |
|---|---|---|---|---|---|
| 1. Technical Feasibility | | | | | |
| a. Ability to construct technology. | i) | Not difficult to construct. No uncertainties in construction. | x | 3 | |
| | ii) | Somewhat difficult to construct. No uncertainties in construction. | | 2 | |
| | iii) | Very difficult to construct and/or significant uncertainties in construction. | | 1 | |
| b. Reliability of technology. | i) | Very reliable in meeting the specified process efficiencies or performance goals. | x | 3 | |
| | ii) | Somewhat reliable in meeting the specified process efficiencies or performance goals. | | 2 | |
| c. Schedule of delays due to technical problems. | i) | Unlikely | x | 2 | |
| | ii) | Somewhat unlikely | | 1 | |
| d. Need of undertaking additional remedial action, if necessary. | i) | No future remedial actions may be anticipated. | x | 2 | |
| | ii) | Some future remedial actions may be necessary. | | 1 | |
| **Subtotal (maximum = 10)** | | | | | 10 |
| 2. Administrative Feasibility | | | | | |
| a. Coordination with other agencies. | i) | Minimal coordination is required. | | 2 | |
| | ii) | Required coordination is normal. | x | 1 | |
| | iii) | Extensive coordination is required. | | 0 | |
| **Subtotal (maximum = 2)** | | | | | 1 |

HOUDAILLE-MANZEL SITE
ALTERNATIVE 2 - CLAY CAP AND CONCRETE CAP (Continued)

**IMPLEMENTABILITY (CONTINUED)**
(Relative Weight = 15)

| Analysis Factor | | Basis for Evaluation During Detailed Analysis | | | Score |
|---|---|---|---|---|---|
| 3. Availability of Services and Materials | | | | | |
| a. Availability of prospective technologies. | i) | Are technologies under consideration generally commercially available for the site-specific application? | **Yes**<br>**No** | x<br>__ | 1<br>0 |
| | ii) | Will more than one vendor be available to provide a competitive bid? | **Yes**<br>**No** | x<br>__ | 1<br>0 |
| b. Availability of necessary equipment and specialists. | i) | Additional equipment and specialists may be available without significant delay. | **Yes**<br>**No** | x<br>__ | 1<br>0 |
| | | | | | 3 |
| **Subtotal (maximum = 3)** | | | | | |
| **TOTAL (maximum = 15)** | | | | | 14 |

HOUDAILLE-MANZEL SITE
ALTERNATIVE 4 - EXCAVATION (>500 PPM LEAD)/OFF-SITE DISPOSAL

**COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)**
(Relative Weight = 10)

| Analysis Factor | Basis for Evaluation During Detailed Analysis | | | Score |
|---|---|---|---|---|
| 1. Compliance with chemical-specific SCGs. | Meets chemical specific SCGs such as groundwater standards. | **Yes** | x | 4 |
| | | **No** | ___ | 0 |
| 2. Compliance with action-specific SCGs. | Meets SCGs such as technology standards for incineration or landfill. | **Yes** | x | 3 |
| | | **No** | ___ | 0 |
| 3. Compliance with location-specific SCGs. | Meets location-specific SCGS such as Freshwater Wetlands Act. | **Yes** | x | 3 |
| | | **No** | ___ | 0 |
| **TOTAL (maximum = 10)** | | | | 10 |

## HOUDAILLE-MANZEL SITE
## ALTERNATIVE 4 - EXCAVATION (>500 PPM LEAD)/OFF-SITE DISPOSAL (Continued)

### PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

| Analysis Factor | | Basis for Evaluation During Detailed Analysis | | | Score | |
|---|---|---|---|---|---|---|
| 1. Use of the site after remediation. | | Unrestricted use of the land and water. **(If answer is yes, go to the end of the Table.)** | **Yes**<br>**No** | <br>x | 20<br>0 | 0 |
| **TOTAL (maximum = 20)** | | | | | | |
| 2. Human health and the environment exposure after the remediation. | i) | Is the exposure to contaminants via air route acceptable? | **Yes**<br>**No** | x<br> | 3<br>0 | |
| | ii) | Is the exposure to contaminants via groundwater/surface water acceptable? | **Yes**<br>**No** | x<br> | 4<br>0 | |
| | iii) | Is the exposure to contaminants via sediments/soils acceptable? | **Yes**<br>**No** | x<br> | 3<br>0 | 10 |
| **Subtotal (maximum = 10)** | | | | | | |
| 3. Magnitude of residual public health risks after the remediation. | i) | Health risk | ≤ 1 in 1,000,000 | x | 5 | |
| | ii) | Health risk | ≤ 1 in 100,000 | | 2 | 5 |
| **Subtotal (maximum = 5)** | | | | | | |
| 4. Magnitude of residual environmental risks after the remediation. | i) | Less than acceptable | | x | 5 | |
| | ii) | Slightly greater than acceptable | | | 3 | |
| | iii) | Significant risk still exists | | | 0 | 5 |
| **Subtotal (maximum = 5)** | | | | | | |
| **TOTAL (maximum = 20)** | | | | | | 20 |

HOUDAILLE-MANZEL SITE
ALTERNATIVE 4 - EXCAVATION (>500 PPM LEAD)/OFF-SITE DISPOSAL (Continued)

**SHORT-TERM EFFECTIVENESS**
(Relative Weight = 10)

| Analysis Factor | Basis for Evaluation During Detailed Analysis | | | Score |
|---|---|---|---|---|
| 1. Protection of community during remedial actions. | • Are there significant short-term risks to the community that must be addressed? **(If answer is no, go to Factor 2.)** | **Yes** | __ | 0 |
| | | **No** | x | 4 |
| | • Can the risk be easily controlled? | **Yes** | __ | 1 |
| | | **No** | __ | 0 |
| | • Does the mitigative effort to control risk impact the community lifestyle? | **Yes** | __ | 0 |
| | | **No** | __ | 2 |
| **Subtotal (maximum = 4)** | | | | 4 |
| 2. Environmental Impacts | • Are there significant short-term risks to the environment that must be addressed? **(If answer is no, go to Factor 3.)** | **Yes** | __ | 0 |
| | | **No** | x | 4 |
| | • Are the available mitigative measures reliable to minimize potential impacts? | **Yes** | __ | 3 |
| | | **No** | __ | 0 |
| **Subtotal (maximum = 4)** | | | | 4 |
| 3. Time to implement the remedy. | • What is the required time to implement the remedy? | **≤ 2 yr.** | x | 1 |
| | | **> 2 yr.** | __ | 0 |
| | • Required duration of the mitigative effort to control short-term risk. | **≤ 2 yr.** | x | 1 |
| | | **> 2 yr.** | __ | 0 |
| **Subtotal (maximum = 2)** | | | | 2 |
| **TOTAL (maximum = 10)** | | | | 10 |

HOUDAILLE-MANZEL SITE
ALTERNATIVE 4 - EXCAVATION (>500 PPM LEAD)/OFF-SITE DISPOSAL (Continued)

## LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

| Analysis Factor | | Basis for Evaluation During Detailed Analysis | | | | Score |
|---|---|---|---|---|---|---|
| 1. On-site or off-site treatment or land disposal | • | On-site treatment* | | __ | 3 | |
| | • | Off-site treatment* | | __ | 1 | |
| | • | On-site or off-site land disposal | | x | 0 | 0 |
| **Subtotal (maximum = 3)** | | | | | | |
| * treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes | | | | | | |
| 2. Permanence of the remedial alternative. | • | Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 4.)** | **Yes** | __ | 3 | |
| | | | **No** | x | 0 | 0 |
| **Subtotal (maximum = 3)** | | | | | | |
| 3. Lifetime of remedial actions. | • | Expected lifetime or duration of effectiveness of the remedy. | **25-30 yr.** | x | 3 | |
| | | | **20-25 yr.** | __ | 2 | |
| | | | **15-20 yr.** | __ | 1 | |
| | | | **< 15 yr.** | __ | 0 | 3 |
| **Subtotal (maximum = 3)** | | | | | | |
| 4. Quantity and nature of waste or residual left at the site after remediation. | i) | Quantity of untreated hazardous waste left at the site. | **None** | x | 3 | |
| | | | **< 25%** | __ | 2 | |
| | | | **25-50%** | __ | 1 | |
| | | | **> 50%** | __ | 0 | |
| | ii) | Is there treated residual left at the site? **(If answer is no, go to Factor 5.)** | **Yes** | __ | 0 | |
| | | | **No** | x | 2 | |
| | iii) | Is the treated residual toxic | **Yes** | __ | 0 | |
| | | | **No** | __ | 1 | |
| | iv) | Is the treated residual mobile? | **Yes** | __ | 0 | |
| | | | **No** | __ | 1 | 5 |
| **Subtotal (maximum = 5)** | | | | | | |

HOUDAILLE-MANZEL SITE
ALTERNATIVE 4 - EXCAVATION (>500 PPM LEAD)/OFF-SITE DISPOSAL (Continued)

## LONG-TERM EFFECTIVENESS AND PERMANENCE, CONTINUED
(Relative Weight = 15)

| Analysis Factor | | Basis for Evaluation During Detailed Analysis | | | Score | |
|---|---|---|---|---|---|---|
| 5. Adequacy and reliability of controls. | i) | Operation and maintenance required for a period of: | **< 5 yr.** | x | 1 | |
| | | | **> 5 yr.** | ___ | 0 | |
| | ii) | Are environmental controls required as a part of the remedy to handle potential problems? **(If answer is no, go to "iv")** | **Yes** | x | 0 | |
| | | | **No** | ___ | 1 | |
| | iii) | Degree of confidence that controls can adequately handle potential problems. | **Moderate to very confident** | x | 1 | |
| | | | **Somewhat to not confident** | ___ | 0 | |
| | iv) | Relative degree of long-term monitoring required (**compare with other remedial alternatives** | **Minimum** | x | 2 | |
| | | | **Moderate** | ___ | 1 | |
| | | | **Extensive** | ___ | 0 | |
| **Subtotal (maximum = 4)** | | | | | | 4 |
| **TOTAL (maximum = 15)** | | | | | | 12 |

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HOUDAILLE-MANZEL SITE
ALTERNATIVE 4 - EXCAVATION (>500 PPM LEAD)/OFF-SITE DISPOSAL (Continued)

## REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

| Analysis Factor | | Basis for Evaluation During Detailed Analysis | | | Score | |
|---|---|---|---|---|---|---|
| 1. Volume of hazardous waste reduced (Reduction in volume or toxicity). **If Factor 1 is not applicable, go to Factor 2.** | i) | Quantity of hazardous waste destroyed or treated. **Immobilization technologies do not score under Factor 1.** | **99-100%** | __ | 8 | |
| | | | **90-99%** | __ | 7 | |
| | | | **80-90%** | __ | 6 | |
| | | | **60-80%** | __ | 4 | |
| | | | **40-60%** | __ | 2 | |
| | | | **20-40%** | __ | 1 | |
| | | | **< 20%** | x | 0 | |
| | ii) | Are there untreated or concentrated hazardous waste produced as a result of (i)? **If answer is no, go to Factor 2.** | **Yes** | __ | 0 | |
| | | | **No** | __ | 2 | |
| **Subtotal (maximum = 10) (If subtotal = 10, go to Factor 3)** | iii) | After remediation, how is the untreated, residual hazardous waste material disposed? | **Off-site land disposal** | __ | 0 | |
| | | | **On-site land disposal** | __ | 1 | |
| | | | **Offsite destruction or treatment** | __ | 2 | 0 |
| 2. Reduction in mobility of hazardous waste. **If Factor 2 is not applicable, go to Factor 3.** | i) | Quantity of Available Wastes Immobilized After Destruction/ Treatment | **90-100%** | x | 2 | |
| | | | **60-90%** | __ | 1 | |
| | | | **< 60%** | __ | 0 | |
| | ii) | Method of Immobilization | | | | |
| | | - Reduced mobility by containment | | x | 0 | |
| **Subtotal (maximum = 5)** | | - Reduced mobility by alternative treatment technologies | | __ | 3 | 2 |
| 3. Irreversibility of the destruction or treatment of hazardous waste. | i) | Completely irreversible | | __ | 5 | |
| | ii) | Irreversible for most of the hazardous waste constituents. | | __ | 3 | |
| | iii) | Irreversible for only some of the hazardous waste constituents. | | __ | 2 | |
| | iv) | Reversible for most of the hazardous waste constituents. | | x | 0 | 0 |
| **Subtotal (maximum = 5)** | | | | | | |
| **TOTAL (maximum = 15)** | | | | | | **2** |

## HOUDAILLE-MANZEL SITE
## ALTERNATIVE 4 - EXCAVATION (>500 PPM LEAD)/OFF-SITE DISPOSAL (Continued)

**IMPLEMENTABILITY**
(Relative Weight = 15)

| Analysis Factor | | Basis for Evaluation During Detailed Analysis | | **Score** | |
|---|---|---|---|---|---|
| 1. Technical Feasibility | | | | | |
| a. Ability to construct technology. | i) | Not difficult to construct. No uncertainties in construction. | x | 3 | |
| | ii) | Somewhat difficult to construct. No uncertainties in construction. | __ | 2 | |
| | iii) | Very difficult to construct and/or significant uncertainties in construction. | __ | 1 | |
| b. Reliability of technology. | i) | Very reliable in meeting the specified process efficiencies or performance goals. | x | 3 | |
| | ii) | Somewhat reliable in meeting the specified process efficiencies or performance goals. | __ | 2 | |
| c. Schedule of delays due to technical problems. | i) | Unlikely | x | 2 | |
| | ii) | Somewhat unlikely | __ | 1 | |
| d. Need of undertaking additional remedial action, if necessary. | i) | No future remedial actions may be anticipated. | x | 2 | |
| | ii) | Some future remedial actions may be necessary. | __ | 1 | 10 |
| **Subtotal (maximum = 10)** | | | | | |
| 2. Administrative Feasibility | | | | | |
| a. Coordination with other agencies. | i) | Minimal coordination is required. | __ | 2 | |
| | ii) | Required coordination is normal. | x | 1 | |
| | iii) | Extensive coordination is required. | __ | 0 | 1 |
| **Subtotal (maximum = 2)** | | | | | |

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## IMPLEMENTABILITY (CONTINUED)

(Relative Weight = 15)

| Analysis Factor | | Basis for Evaluation During Detailed Analysis | | | Score | |
|---|---|---|---|---|---|---|
| 3. Availability of Services and Materials | | | | | | |
| a. Availability of prospective technologies. | i) | Are technologies under consideration generally commercially available for the site-specific application? | **Yes**<br>**No** | x<br>__ | 1<br>0 | |
| | ii) | Will more than one vendor be available to provide a competitive bid? | **Yes**<br>**No** | x<br>__ | 1<br>0 | |
| b. Availability of necessary equipment and specialists. | i) | Additional equipment and specialists may be available without significant delay. | **Yes**<br>**No** | x<br>__ | 1<br>0 | 3 |
| **Subtotal (maximum = 3)** | | | | | | |
| **TOTAL (maximum = 15)** | | | | | | 14 |

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HOUDAILLE-MANZEL SITE
ALTERNATIVE 5 - "HOT-SPOT" EXCAVATION/OFF-SITE
DISPOSAL/BASIC SOIL CAP AND CONCRETE CAP

**COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)**

(Relative Weight = 10)

| Analysis Factor | Basis for Evaluation During Detailed Analysis | | | Score |
|---|---|---|---|---|
| 1. Compliance with chemical-specific SCGs. | Meets chemical specific SCGs such as groundwater standards. | **Yes** | x | 4 |
| | | **No** | ___ | 0 |
| 2. Compliance with action-specific SCGs. | Meets SCGs such as technology standards for incineration or landfill. | **Yes** | x | 3 |
| | | **No** | ___ | 0 |
| 3. Compliance with location-specific SCGs. | Meets location-specific SCGS such as Freshwater Wetlands Act. | **Yes** | x | 3 |
| | | **No** | ___ | 0 |
| **TOTAL (maximum = 10)** | | | | **10** |

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HOUDAILLE-MANZEL SITE
ALTERNATIVE 5 - "HOT-SPOT" EXCAVATION/OFF-SITE
DISPOSAL/BASIC SOIL CAP AND CONCRETE CAP (Continued)

**PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT**
(Relative Weight = 20)

| Analysis Factor | | Basis for Evaluation During Detailed Analysis | | | | Score |
|---|---|---|---|---|---|---|
| 1. Use of the site after remediation. | | Unrestricted use of the land and water. **(If answer is yes, go to the end of the Table.)** | **Yes** | __ | 20 | |
| | | | **No** | x | 0 | 0 |
| **TOTAL (maximum = 20)** | | | | | | |
| 2. Human health and the environment exposure after the remediation. | i) | Is the exposure to contaminants via air route acceptable? | **Yes** | x | 3 | |
| | | | **No** | __ | 0 | |
| | ii) | Is the exposure to contaminants via groundwater/surface water acceptable? | **Yes** | x | 4 | |
| | | | **No** | __ | 0 | |
| | iii) | Is the exposure to contaminants via sediments/soils acceptable? | **Yes** | x | 3 | |
| | | | **No** | __ | 0 | 10 |
| **Subtotal (maximum = 10)** | | | | | | |
| 3. Magnitude of residual public health risks after the remediation. | i) | Health risk | ≤ 1 in 1,000,000 | x | 5 | |
| | ii) | Health risk | ≤ 1 in 100,000 | __ | 2 | 5 |
| **Subtotal (maximum = 5)** | | | | | | |
| 4. Magnitude of residual environmental risks after the remediation. | i) | Less than acceptable | | x | 5 | |
| | ii) | Slightly greater than acceptable | | __ | 3 | |
| | iii) | Significant risk still exists | | __ | 0 | 5 |
| **Subtotal (maximum = 5)** | | | | | | |
| **TOTAL (maximum = 20)** | | | | | | 20 |

HOUDAILLE-MANZEL SITE
ALTERNATIVE 5 - "HOT-SPOT" EXCAVATION/OFF-SITE
DISPOSAL/BASIC SOIL CAP AND CONCRETE CAP (Continued)

**SHORT-TERM EFFECTIVENESS**
(Relative Weight = 10)

| Analysis Factor | Basis for Evaluation During Detailed Analysis | | | Score | |
|---|---|---|---|---|---|
| 1. Protection of community during remedial actions. | • Are there significant short-term risks to the community that must be addressed? **(If answer is no, go to Factor 2.)** | **Yes**<br>**No** | __<br>x | 0<br>4 | |
| | • Can the risk be easily controlled? | **Yes**<br>**No** | __<br>__ | 1<br>0 | |
| | • Does the mitigative effort to control risk impact the community lifestyle? | **Yes**<br>**No** | __<br>__ | 0<br>2 | 4 |
| **Subtotal (maximum = 4)** | | | | | |
| 2. Environmental Impacts | • Are there significant short-term risks to the environment that must be addressed? **(If answer is no, go to Factor 3.)** | **Yes**<br>**No** | __<br>x | 0<br>4 | |
| | • Are the available mitigative measures reliable to minimize potential impacts? | **Yes**<br>**No** | __<br>__ | 3<br>0 | 4 |
| **Subtotal (maximum = 4)** | | | | | |
| 3. Time to implement the remedy. | • What is the required time to implement the remedy? | **≤ 2 yr.**<br>**> 2 yr.** | x<br>__ | 1<br>0 | |
| | • Required duration of the mitigative effort to control short-term risk. | **≤ 2 yr.**<br>**> 2 yr.** | x<br>__ | 1<br>0 | 2 |
| **Subtotal (maximum = 2)** | | | | | |
| **TOTAL (maximum = 10)** | | | | | 10 |

HOUDAILLE-MANZEL SITE
ALTERNATIVE 5 - "HOT-SPOT" EXCAVATION/OFF-SITE
DISPOSAL/BASIC SOIL CAP AND CONCRETE CAP (Continued)

**LONG-TERM EFFECTIVENESS AND PERMANENCE**
(Relative Weight = 15)

| Analysis Factor | | Basis for Evaluation During Detailed Analysis | | | Score | |
|---|---|---|---|---|---|---|
| 1. On-site or off-site treatment or land disposal | • | On-site treatment* | | ___ | 3 | |
| | • | Off-site treatment* | | ___ | 1 | |
| | • | On-site or off-site land disposal | | x | 0 | |
| **Subtotal (maximum = 3)** | | | | | | 0 |
| * treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes | | | | | | |
| 2. Permanence of the remedial alternative. | • | Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 4.)** | **Yes** | ___ | 3 | |
| | | | **No** | x | 0 | |
| **Subtotal (maximum = 3)** | | | | | | 0 |
| 3. Lifetime of remedial actions. | • | Expected lifetime or duration of effectiveness of the remedy. | **25-30 yr.** | x | 3 | |
| | | | **20-25 yr.** | ___ | 2 | |
| | | | **15-20 yr.** | ___ | 1 | |
| | | | **< 15 yr.** | ___ | 0 | |
| **Subtotal (maximum = 3)** | | | | | | 3 |
| 4. Quantity and nature of waste or residual left at the site after remediation. | i) | Quantity of untreated hazardous waste left at the site. | **None** | x | 3 | |
| | | | **< 25%** | ___ | 2 | |
| | | | **25-50%** | ___ | 1 | |
| | | | **> 50%** | ___ | 0 | |
| | ii) | Is there treated residual left at the site? **(If answer is no, go to Factor 5.)** | **Yes** | ___ | 0 | |
| | | | **No** | x | 2 | |
| | iii) | Is the treated residual toxic | **Yes** | ___ | 0 | |
| | | | **No** | ___ | 1 | |
| | iv) | Is the treated residual mobile? | **Yes** | ___ | 0 | |
| | | | **No** | ___ | 1 | |
| **Subtotal (maximum = 5)** | | | | | | 5 |

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HOUDAILLE-MANZEL SITE
ALTERNATIVE 5 - "HOT-SPOT" EXCAVATION/OFF-SITE DISPOSAL/BASIC SOIL CAP AND CONCRETE CAP (Continued)

**LONG-TERM EFFECTIVENESS AND PERMANENCE, CONTINUED**
(Relative Weight = 15)

| Analysis Factor | | Basis for Evaluation During Detailed Analysis | | | Score |
|---|---|---|---|---|---|
| 5. Adequacy and reliability of controls. | i) | Operation and maintenance required for a period of: | **< 5 yr.** | __ | 1 |
| | | | **> 5 yr.** | x | 0 |
| | ii) | Are environmental controls required as a part of the remedy to handle potential problems? **(If answer is no, go to "iv")** | **Yes** | x | 0 |
| | | | **No** | __ | 1 |
| | iii) | Degree of confidence that controls can adequately handle potential problems. | **Moderate to very confident** | x | 1 |
| | | | **Somewhat to not confident** | __ | 0 |
| | iv) | Relative degree of long-term monitoring required **(compare with other remedial alternatives** | **Minimum** | x | 2 |
| | | | **Moderate** | __ | 1 |
| | | | **Extensive** | __ | 0 |
| | | | | | 3 |
| **Subtotal (maximum = 4)** | | | | | |
| **TOTAL (maximum = 15)** | | | | | 11 |

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HOUDAILLE-MANZEL SITE
ALTERNATIVE 5 - "HOT-SPOT" EXCAVATION/OFF-SITE DISPOSAL/BASIC SOIL CAP AND CONCRETE CAP (Continued)

## REDUCTION OF TOXICITY, MOBILITY OR VOLUME

(Relative Weight = 15)

| Analysis Factor | | Basis for Evaluation During Detailed Analysis | | | Score | Subtotal |
|---|---|---|---|---|---|---|
| 1. Volume of hazardous waste reduced (Reduction in volume or toxicity). **If Factor 1 is not applicable, go to Factor 2.** | i) | Quantity of hazardous waste destroyed or treated. **Immobilization technologies do not score under Factor 1.** | **99-100%** | ___ | 8 | |
| | | | **90-99%** | ___ | 7 | |
| | | | **80-90%** | ___ | 6 | |
| | | | **60-80%** | ___ | 4 | |
| | | | **40-60%** | ___ | 2 | |
| | | | **20-40%** | ___ | 1 | |
| | | | **< 20%** | x | 0 | |
| | ii) | Are there untreated or concentrated hazardous waste produced as a result of (i)? **If answer is no, go to Factor 2.** | **Yes** | ___ | 0 | |
| | | | **No** | ___ | 2 | |
| **Subtotal (maximum = 10) (If subtotal = 10, go to Factor 3)** | iii) | After remediation, how is the untreated, residual hazardous waste material disposed? | **Off-site land disposal** | ___ | 0 | |
| | | | **On-site land disposal** | ___ | 1 | |
| | | | **Offsite destruction or treatment** | ___ | 2 | 0 |
| 2. Reduction in mobility of hazardous waste. **If Factor 2 is not applicable, go to Factor 3.** | i) | Quantity of Available Wastes Immobilized After Destruction/ Treatment | **90-100%** | x | 2 | |
| | | | **60-90%** | ___ | 1 | |
| | | | **< 60%** | ___ | 0 | |
| | ii) | Method of Immobilization | | | | |
| | | - Reduced mobility by containment | | x | 0 | |
| **Subtotal (maximum = 5)** | | - Reduced mobility by alternative treatment technologies | | ___ | 3 | 2 |
| 3. Irreversibility of the destruction or treatment of hazardous waste. | i) | Completely irreversible | | ___ | 5 | |
| | ii) | Irreversible for most of the hazardous waste constituents. | | ___ | 3 | |
| | iii) | Irreversible for only some of the hazardous waste constituents. | | x | 2 | |
| | iv) | Reversible for most of the hazardous waste constituents. | | x | 0 | 0 |
| **Subtotal (maximum = 5)** | | | | | | |
| **TOTAL (maximum = 15)** | | | | | | **2** |

## HOUDAILLE-MANZEL SITE
## ALTERNATIVE 5 - "HOT-SPOT" EXCAVATION/OFF-SITE DISPOSAL/BASIC SOIL CAP AND CONCRETE CAP (Continued)

### IMPLEMENTABILITY
(Relative Weight = 15)

| Analysis Factor | | Basis for Evaluation During Detailed Analysis | | Score | |
|---|---|---|---|---|---|
| 1. Technical Feasibility | | | | | |
| a. Ability to construct technology. | i) | Not difficult to construct. No uncertainties in construction. | x | 3 | |
| | ii) | Somewhat difficult to construct. No uncertainties in construction. | | 2 | |
| | iii) | Very difficult to construct and/or significant uncertainties in construction. | | 1 | |
| b. Reliability of technology. | i) | Very reliable in meeting the specified process efficiencies or performance goals. | x | 3 | |
| | ii) | Somewhat reliable in meeting the specified process efficiencies or performance goals. | | 2 | |
| c. Schedule of delays due to technical problems. | i) | Unlikely | x | 2 | |
| | ii) | Somewhat unlikely | | 1 | |
| d. Need of undertaking additional remedial action, if necessary. | i) | No future remedial actions may be anticipated. | x | 2 | |
| | ii) | Some future remedial actions may be necessary. | | 1 | |
| **Subtotal (maximum = 10)** | | | | | 10 |
| 2. Administrative Feasibility | | | | | |
| a. Coordination with other agencies. | i) | Minimal coordination is required. | | 2 | |
| | ii) | Required coordination is normal. | x | 1 | |
| | iii) | Extensive coordination is required. | | 0 | |
| **Subtotal (maximum = 2)** | | | | | 1 |

HOUDAILLE-MANZEL SITE
ALTERNATIVE 5 - "HOT-SPOT" EXCAVATION/OFF-SITE
DISPOSAL/BASIC SOIL CAP AND CONCRETE CAP (Continued)

**IMPLEMENTABILITY (CONTINUED)**
(Relative Weight = 15)

| Analysis Factor | | Basis for Evaluation During Detailed Analysis | | | | Score |
|---|---|---|---|---|---|---|
| 3. Availability of Services and Materials | | | | | | |
| a. Availability of prospective technologies. | i) | Are technologies under consideration generally commercially available for the site-specific application? | **Yes**<br>**No** | x<br>__ | 1<br>0 | |
| | ii) | Will more than one vendor be available to provide a competitive bid? | **Yes**<br>**No** | x<br>__ | 1<br>0 | |
| b. Availability of necessary equipment and specialists. | i) | Additional equipment and specialists may be available without significant delay. | **Yes**<br>**No** | x<br>__ | 1<br>0 | |
| **Subtotal (maximum = 3)** | | | | | | 3 |
| **TOTAL (maximum = 15)** | | | | | | 14 |

# APPENDIX K

# COST AND MATERIAL VOLUME ESTIMATE

APPENDIX K.1 COST ESTIMATES

APPENDIX K.2 MATERIAL VOLUME ESTIMATES

# APPENDIX K.1

# COST ESTIMATES

# HOUDAILLE–MANZEL SITE
# COST ESTIMATE SUMMARY

| ALTERNATIVE | PW COST | TAGM SCORE |
|---|---|---|
| 1. No Action | $61,295 | 15 |
| 2. Clay & Concrete Caps | $251,655 | 14 |
| 4. Excavation(>500 ppm Lead)/ Off–Site Disposal | $1,981,568 | 0 |
| 5. "Hot Spot" Excavation/ Off–Site Disposal/Basic Soil and Concrete Caps | $495,917 | 12 |

# HOUDAILLE–MANZEL SITE
# COST ESTIMATE

**Alternative 1 – No Action/Long Term Monitoring**

Capital Costs Pc = 0 (No Construction Required)

Annual Operation and Maintenance Costs

| Item | Description | Unit | Quantity | Unit Cost | Total Cost |
|---|---|---|---|---|---|
| I | ANNUAL REPORT | LS | 1 | $3,000 | $3,000 |
| II | GROUNDWATER MONITORING<br>(Sampling, analytical testing & reporting) | Round | 1 | $2,000 | $2,000 |
| III | SOIL MONITORING<br>(Sampling, analytical testing & reporting) | Round | 1 | $1,500 | $1,500 |
| | TOTAL O & M COSTS (Po+m) | | | | $6,500 |
| | ALTERNATIVE 1 TOTAL PW COSTS (Pt = Pc + 9.43*Po+m) | | | | **$61,295** |

**Alternative 2 – Clay and Concrete Caps**

Capital Costs

| Item | | Description | Unit | Quantity | Unit Cost | Total Cost |
|---|---|---|---|---|---|---|
| I | | MOBILIZATION/DEMOBILIZATION | | | | |
| | Ia | Equipment | LS | 1 | $3,000 | $3,000 |
| | Ib | Misc. Construction Expenses | LS | 1 | $1,000 | $1,000 |
| I | | Subtotal | | | | $4,000 |
| II | | SITE PREPARATION | | | | |
| | IIa | Access & Perimeter Roads | LS | 1 | $3,000 | $3,000 |
| | IIb | Equipment Decon. Pad | Ea | 1 | $5,000 | $5,000 |
| | IIc | Personnel Decon. | LS | 1 | $500 | $500 |
| | IId | Site Topo & Record Survey | Days | 2 | $800 | $1,600 |
| | IIe | Security | LS | 1 | $1,000 | $1,000 |
| | IIf | Work/H&S/O&M Plans | LS | 1 | $10,000 | $10,000 |
| | IIg | Health & Safety Equip./Disposal | LS | 1 | $5,000 | $5,000 |
| | IIh | Utilities Installation | LS | 1 | $0 | $0 |
| | IIi | Electricity | LS | 1 | $0 | $0 |
| | IIj | Water | LS | 1 | $0 | $0 |
| | IIk | Office Supplies | Months | 1 | $100 | $100 |
| | IIl | Office Trailer Rental & Installation | Ea | 2 | $1,000 | $2,000 |
| | IIm | Fence Removal | LS | 1 | $1,000 | $1,000 |
| | IIn | Bonding & Insurance | LS | 1 | $10,000 | $10,000 |
| II | | Subtotal | | | | $39,200 |
| III | | CAP INSTALLATION | | | | |
| | a | Clay & Topsoil Cap, Seeding | SF | 32000 | $2.50 | $80,000 |
| | b | Concrete Cap | SF | 15000 | $2.00 | $30,000 |
| III | | Subtotal | | | | $110,000 |
| IV | | RESTORATION | | | | |
| | a | Site Clearing | LS | 1 | $1,000 | $1,000 |
| | b | Fence Reinstallation | LS | 1 | $1,500 | $1,500 |
| IV | | Subtotal | | | | $2,500 |
| V | | MEETINGS & REPORTS | LS | 1 | $5,000 | $5,000 |
| | | SUBTOTAL CAPITAL COSTS | | | | $160,700 |
| | | Engineering | 10.0% | | | $16,070 |
| | | Contingency | 20.0% | | | $32,140 |
| | | State and Local Taxes | 7.0% | | | $11,249 |
| | | TOTAL CAPITAL COSTS (Pc) | | | | $220,159 |

**Altnative 2 – Capping**

Annual Operating and Maintenance costs

| Item | Description | Unit | Quantity | Unit Cost | Total Cost |
|---|---|---|---|---|---|
| I | PERIODIC SITE INSPECTION | Hrs | 20 | $50 | $1,000 |
| II | CAP REPAIRING | Hrs | 40 | $35 | $1,400 |
| III | MATERIAL | LS | 1 | $940 | $940 |
| | TOTAL O & M COSTS (Po+m) | | | | $3,340 |
| | ALTERNATIVE 2 TOTAL PW COSTS (Pt = Pc + 9.43*Po+m) | | | | **$251,655** |

**Alternative 4 – Excavation(>500 ppm Lead)/Off–Site Disposal**

Capital Costs

**Alternative 4 – Excavation(>500 ppm Lead)/Off–Site Disposal**

Capital Costs

| Item | | Description | Unit | Quantity | Unit Cost | Total Cost |
|---|---|---|---|---|---|---|
| I | | MOBILIZATION/DEMOBILIZATION | | | | |
| | Ia | Excavation Equipment | LS | 1 | $4,000 | $4,000 |
| | Ib | Misc. Construction Expenses | LS | 1 | $1,000 | $1,000 |
| I | | Subtotal | | | | $5,000 |
| II | | SITE PREPARATION | | | | |
| | IIa | Clearing & Access Roads | LS | 1 | $3,000 | $3,000 |
| | IIb | Truck Scale | Ea | 1 | $64,000 | $64,000 |
| | IIc | Equipment Decon. Pad | LS | 1 | $17,000 | $17,000 |
| | IId | Personnel Decon. Trailer | LS | 1 | $65,000 | $65,000 |
| | IIe | Site Topo & Record Survey | Days | 5 | $800 | $4,000 |
| | IIf | Security | LS | 1 | $10,000 | $10,000 |
| | IIg | Work/H&S/O&M Plans | LS | 1 | $20,000 | $20,000 |
| | IIh | Erosion Control | LS | 1 | $1,000 | $1,000 |
| | IIi | Health & Safety Equip/Disposal | LS | 1 | $7,000 | $7,000 |
| | IIj | Utilities Installation | LS | 1 | $1,500 | $1,500 |
| | IIk | Electricity & Water | LS | 1 | $1,500 | $1,500 |
| | IIl | Fence Removal | LS | 1 | $1,000 | $1,000 |
| | IIm | Soil Storage Facility | LS | 1 | $2,000 | $2,000 |
| | IIn | Office Supplies | Months | 4 | $200 | $800 |
| | IIo | Office Trailer Rent. & Intall. | Ea | 2 | $2,000 | $4,000 |
| | IIp | Bonding & Insurance | LS | 1 | $65,000 | $65,000 |
| II | | Subtotal | | | | $266,800 |
| III | | EXCAVATION (In–Place Volume) | CY | 7,250 | $10 | $72,500 |
| IV | | SAMPLING AND TESTING | | | | |
| | IVa | Lead | Ea | 80 | $50 | $4,000 |
| | IVb | Wastewater | Ea | 4 | $300 | $1,200 |
| | IVc | Reporting & Data Valid. | LS | 1 | $2,000 | $2,000 |
| IV | | Subtotal | | | | $7,200 |
| V | | PERIODIC AIR MONITORING | Month | 4 | $10,000 | $40,000 |
| VI | | OFF–SITE DISPOSAL/TRANSPORT. | | | | |
| | a | Hazardous Waste | CY | 200 | $300 | $60,000 |
| | b | Non–Hazardous Waste (including 30% volume bulking) | CY | 9,300 | $90 | $837,000 |
| VI | | Subtotal | | | | $897,000 |
| VI | | BACKFILL MATERIAL & COMPACT. | CY | 7,500 | $15 | $112,500 |
| VII | | RESTORATION | | | | |
| | a | Topsoil & Seeding | SF | 47,000 | $0.70 | $32,900 |
| | b | Site Clearing | LS | 1 | $1,000 | $1,000 |
| | c | Fence Reinstallation | LS | 1 | $1,500 | $1,500 |
| VII | | Subtotal | | | | $35,400 |

| | | | | | |
|---|---|---|---|---|---|
| XIII | MEETINGS & REPORTS | LS | 1 | $10,000 | $10,000 |
| | SUBTOTAL CAPITAL COSTS | | | | $1,446,400 |
| | Engineering | 10.0% | | | $144,640 |
| | Contingency | 20.0% | | | $289,280 |
| | State and Local Taxes | 7.0% | | | $101,248 |
| | TOTAL CAPITAL COSTS (Pc) | | | | $1,981,568 |

**Alternative 4 – Excavation(>500 ppm Lead)/Off–Site Disposal**

Annual Operating and Maintenance Costs

| | | | | | |
|---|---|---|---|---|---|
| I | ANNUAL SITE O & M COSTS (Po+m) | LS | 1 | $0 | $0 |
| | ALTERNATIVE 4 TOTAL PW COSTS (Pt = Pc + 9.43*Po+m) | | | | **$1,981,568** |

**Alternative 5 – "Hot Spot" Excavation/Off–Site Disposal /Basic Soil and Concrete Caps**

Capital Costs

| Item | | Description | Unit | Quantity | Unit Cost | Total Cost |
|---|---|---|---|---|---|---|
| I | | MOBILIZATION/DEMOBILIZATION | | | | |
| | Ia | Excavation Equipment | LS | 1 | $4,000 | $4,000 |
| | Ib | Misc. Construction Expenses | LS | 1 | $1,000 | $1,000 |
| I | | Subtotal | | | | $5,000 |
| II | | SITE PREPARATION | | | | |
| | IIa | Clearing & Access Roads | LS | 1 | $3,000 | $3,000 |
| | IIb | Equipment Decon. Pad | LS | 1 | $17,000 | $17,000 |
| | IIc | Personnel Decon. Trailer | LS | 1 | $65,000 | $65,000 |
| | IId | Site Topo & Record Survey | Days | 3 | $800 | $2,400 |
| | IIe | Security | LS | 1 | $10,000 | $10,000 |
| | IIf | Work/H&S/O&M Plans | LS | 1 | $20,000 | $20,000 |
| | IIg | Erosion Control | LS | 1 | $500 | $500 |
| | IIh | Health & Safety Equip/Disposal | LS | 1 | $7,000 | $7,000 |
| | IIi | Utilities Installation | LS | 1 | $1,500 | $1,500 |
| | IIj | Electricity & Water | LS | 1 | $1,500 | $1,500 |
| | IIk | Fence Removal | LS | 1 | $1,000 | $1,000 |
| | IIl | Office Supplies | Months | 2 | $200 | $400 |
| | IIm | Office Trailer Rent. & Intall. | Ea | 2 | $1,000 | $2,000 |
| | IIn | Bonding & Insurance | LS | 1 | $30,000 | $30,000 |
| II | | Subtotal | | | | $161,300 |
| III | | EXCAVATION | CY | 200 | $20 | $4,000 |
| IV | | SAMPLING AND TESTING | | | | |
| | IVa | Lead | Ea | 20 | $50 | $1,000 |
| | IVb | EP Tox. Lead | Ea | 5 | $220 | $1,100 |
| | IVc | Wastewater | Ea | 4 | $300 | $1,200 |
| | IVd | Reporting & Data Valid. | LS | 1 | $2,000 | $2,000 |
| IV | | Subtotal | | | | $5,300 |
| V | | PERIODIC AIR MONITORING | Month | 2 | $10,000 | $20,000 |
| VI | | OFF–SITE DISPOSAL/TRANSPORT. | | | | |
| | a | Hazardous Waste | CY | 200 | $300 | $60,000 |
| | b | Non–Hazardous Waste | CY | 0 | $90 | $0 |
| VI | | Subtotal | | | | $60,000 |
| VII | | BACKFILL MATERIAL & COMPACT. | CY | 200 | $15 | $3,000 |
| VIII | | CAP INSTALLATION | | | | |
| | a | Basic Soil Cap | SF | 30,000 | $1.80 | $54,000 |
| | b | Concrete Cap | SF | 15,000 | $2 | $30,000 |
| VIII | | Subtotal | | | | $84,000 |

| | | | | | | |
|---|---|---|---|---|---|---|
| IX | | RESTORATION | | | | |
| | a | Site Clearing | LS | 1 | $1,000 | $1,000 |
| | b | Fence Reinstallation | LS | 1 | $1,500 | $1,500 |
| IX | | Subtotal | | | | $2,500 |
| X | | MEETINGS & REPORTS | LS | 1 | $10,000 | $10,000 |
| | | SUBTOTAL CAPITAL COSTS | | | | $355,100 |
| | | Engineering | 10.0% | | | $35,510 |
| | | Contingency | 20.0% | | | $71,020 |
| | | State and Local Taxes | 7.0% | | | $24,857 |
| | | TOTAL CAPITAL COSTS (Pc) | | | | $486,487 |

**Alternative 5 – "Hot Spot" Excavation/Off–Site Disposal**
/Basic Soil and Concrete Caps
Annual Operating and Maintenance Costs

| | | | | | |
|---|---|---|---|---|---|
| I | ANNUAL SITE(CAP) O & M COSTS (Po+m) | LS | 1 | $1,000 | $1,000 |
| | ALTERNATIVE 4 TOTAL PW COSTS (Pt = Pc + 9.43*Po+m) | | | | **$495,917** |

# APPENDIX K.2

# MATERIAL VOLUME ESTIMATES

sy 117.06

# IN-PLACE SOIL VOLUME ESTIMATE
# HOUDAILLE-MANZEL SITE

**A. VOLUME OF SOIL WITH LEAD CONCETRATION > 500 PPM**

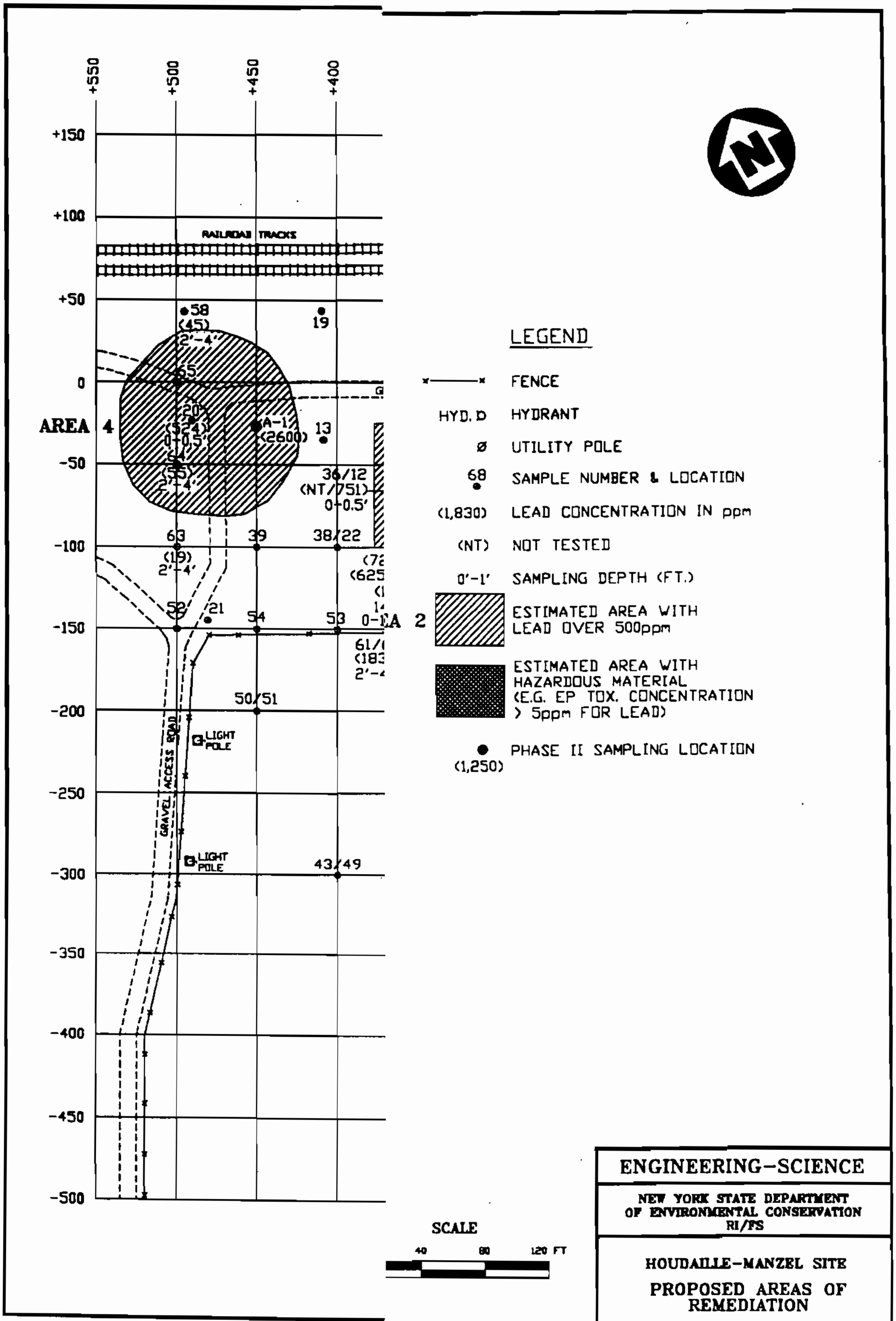
| LOCATION | AREA MEASUREMENTS | AREA(ft**2) | APPROX. DEPTH(ft) | IN-PLACE VOLUME (ft**3) | IN-PLACE VOLUME (yd**3) |
|---|---|---|---|---|---|
| 1 | 90*125+25*75+25*100+40*60 | 18,025 | 4 | 72,100 | 2,670 |
| 2 | 60*85+40*75+50*70 | 11,600 | 4 | 46,400 | 1,719 |
| 3 | 2*(25*300) | 15000 | 3 | 45,000 | 1,667 |
| 4 | 90*90 | 8,100 | 4 | 32,400 | 1,200 |
| SUBTOTALS ====> | | 52,725 | | 195,900 | **7,256** |

Note: Location 3 – All samples were taken from < 1' deep. The maximum depth is unknown. Excavation below 3' might undermine road and possibly building foundation.

**B. VOLUME OF HAZARDOUS SOIL (WITH EP TOXICITY LEAD > 5 PPM)**

| LOCATION | AREA MEASUREMENTS | AREA(ft**2) | APPROX. DEPTH(ft) | IN-PLACE VOLUME (ft**3) | IN-PLACE VOLUME (yd**3) |
|---|---|---|---|---|---|
| NE of Imson St. | 50*20+5*25 | 1125 | 4 | 4,500 | **167** |

# FIGURE K.1




ENGINEERING-SCIENCE

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION RI/FS

HOUDAILLE-MANZEL SITE

PROPOSED AREAS OF REMEDIATION

000830IB\SY117\SY11700L.DWG

# APPENDIX L

# TREATABILITY TECHNOLOGY DOCUMENTATION

APPENDIX L.1 SOIL WASHING/FLUSHING

APPENDIX L.2 SOIL STABILIZATION

# APPENDIX L.1

# SOIL WASHING/FLUSHING

United States
Environmental Protection
Agency

Office of
Solid Waste
and Emergency Response

Office of Emergency
and Remedial Response
Washington DC 20460

Superfund

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EPA

# Mobile Treatment Technologies for Superfund Wastes

## 5.8 SOIL FLUSHING/SOIL WASHING

Process Description

These processes extract contaminants from a sludge-soil matrix using a liquid medium as the washing solution. This washing solution is then treated for removal of the contaminants via a conventional wastewater treatment system. Soil washing can be used on sludge and excavated soils fed into a contactor or washing unit. A similar process known as soil flushing can be applied on unexcavated soils (in situ) using an injection/recirculation system.

Washing fluids may be composed of the following:

- o Water,
- o Organic solvents,
- o Water/chelating agents,
- o Water/surfactants, and
- o Acids or bases.

After the contaminants have been removed from the washing fluid, the fluid may be recycled through the soil washing unit. In the case of in situ soil flushing, the treated washing solution may be reinjected into the soil via a recirculation system. Soils may require multiple washing/flushing cycles for effective contaminant removal. Only certain types of soils may be washed and the soil must be uniform.

Soil washing systems. Tank treatment systems using excavated soils can have certain advantages:

- o Close process control can provide more effective contaminant removal, as disaggregation of soils improves soil water contact,

- o Use of strong additives or washing fluids such as solvents is simplified due to the elimination of the risk of uncontrolled groundwater contamination and environmental degradation, and

- o Smaller volumes of washing fluid are required and fluid recycling improved.

Soil flushing systems. These systems can be used very effectively in conjunction with mobile groundwater treatment systems. Pump and treatment systems for groundwater can be combined with injection of washing fluids upgradient of the extraction wells to produce accelerated flushing and decontamination of soils and groundwater in situ. The treated groundwater can be reinjected as a washing fluid, creating a closed loop recirculation system. Combined groundwater/soil flushing systems can eliminate the costs of removing contaminated soils off site and reduce the cost of separate soil washing and groundwater treatment systems.

Treatment of washing fluids. The leachate collected from the soil contacting process can be recycled by selecting a treatment process for the particular contaminants, e.g., air stripping of water for VOC removal. The separation of the extracted contaminants from the washing fluid can be accomplished by conventional treatment systems suited to the particular contaminants. Problems have arisen with the use of water/surfactant systems because a leachate treatment system has not yet been developed to selectively remove contaminants and pass the surfactants through intact.

Waste Type Handled

Depending on the type of washing fluid additives used for the enhancement of contaminant removal, waste types that can be removed using soil washing/flushing include the following:

- o Heavy metals (e.g., lead, copper, zinc),
- o Halogenated solvents (e.g., TCE, trichloroethane),
- o Aromatics (e.g., benzene, toluene, cresol, phenol),
- o Gasoline and fuel oils, and
- o PCBs and chlorinated phenols.

Removal of each waste type is enhanced through addition of the following compounds:

| Waste Type | Compound |
|---|---|
| Metals: Cations | Weak acids, reducing agents, or chelating agents (ethylene diamine tetracetic acid and citric acid) |
| Anions (arsenic, selenium) | Water with oxidizers ($H_2O_2$) |
| Organics (insoluble) | Organic solvents (alcohols, alkanes) or water with surfactants |
| Organics (soluble) | Water only, or water with surfactants |

Desirable washing fluid characteristics for soil washing are listed below:

- o Favorable separation coefficient for extraction,
- o Low volatility,
- o Low toxicity,
- o Safety and ease of handling,
- o Recoverability, and
- o Treatability of washing fluid.

The areal distribution of waste types is very important in determining the effectiveness of this process. Variability of waste types can make formulation of suitable washing fluids difficult. Some contaminants may be removed effectively while others are not (e.g., solvents and metals may be difficult to remove simultaneously).

Restrictive Waste/Site Characteristics

In situ flushing systems have limitations due to the lack of close process control in the subsurface. Critical site factors include the following:

- Soil characteristics

  - highly variable soil conditions can produce inconsistent flushing
  - high organic content can inhibit desorption of the contaminants
  - low permeability (high silt or clay content) reduces percolation and leaching
  - chemical reactions with soil, cation exchange and pH effects may decrease contaminant mobility

- Site hydrology

  - groundwater flow must be well-defined, permitting recapture of soil washing fluids.

These systems have experienced some problems related to solid/liquid separation subsequent to the washing phase. This is often due to the high percentage of silt or clay in the soil material. This important unit operation should be considered when evaluating the applicability of this process to a site.

Whether in situ or excavation systems are utilized, laboratory and pilot testing will be necessary to determine feasibility. Contaminant removal rates may not be adequate to reduce soil contamination below required action levels.

Required Onsite Facilities/Capabilities

All systems employing this process are mobile and are set up at the contamination site, as transportation costs for moving the soil would make this system uneconomical. Soil flushing is the most common application and is often utilized in conjunction with a contaminated groundwater treatment system. The groundwater is pumped out through extraction wells, treated and reinjected upgradient (sprayed above soils if in the unsaturated zone) and leached through the contaminated soil. The leachate is then recollected through the extraction wells, treated and reinjected back into the system, providing for a closed loop system.

The soil washing process includes soil washing systems such as countercurrent extraction equipment, a pug mill, or a truck-loaded cement mixer. A soil washing system treating excavated contaminated soils can provide a more effective removal process through better soil-water contact and enable less water volume to be used for an equivalent waste removal process.

Environmental Impacts

As with other mobile systems, residues and unrecyclable washing fluid may require further treatment and disposal off site. Effluent from mobile soil washing systems may require further treatment before final discharge to municipal sewer systems or offsite drainage systems, as discussed in Section 5.1.

With soil flushing systems, potential does exist for generating some soil and groundwater contamination from the washing fluid itself. Use of biodegradable additives in the washing fluid may prevent contamination of the soil and groundwater by the washing fluid.

## Costs

Several systems have been employed at hazardous waste sites, however none have been sufficiently developed to estimate costs. A soil washing system that is being tested at Lee's Farm, Wisconsin has an estimated cost of about \$150-\$200/$yd^3$ excluding development costs. The major cost of the project is usually associated with the washing fluid treatment system.

## Commercial Applications

Currently, several hazardous waste sites throughout the country are employing or plan to employ this technique for the cleanup of contaminated soils. Some have reached more developed stages than others but all have had to test this system on the site-specific conditions of concern.

A list of sites where this technology has been used includes the following:

- Volk Air National Guard Base, Juneau County, Wisconsin. Performed by the Air Force Engineering and Service Center, Tyndall AFB, FL 32403-6001. Soils contaminated with volatile organics were leached with water/2% surfactant and the leachate was regenerated by air stripping.

- Lee's Farm Wisconsin - Battery Manufacturing. Lead-contaminated soils were leached with water/5% EDTA and the leachate was regenerated by electrolysis. Contact Charlie Castle, on-scene coordinator in EPA Region V. (312) ~~535~~ 353-2318. (312) 886-5892 Charlie Castle retired

- Celtor Chemical Works, Hoopa Indian Reservation - Ore Enrichment Plant: Tailings which include cadmium, copper and zinc. Contact Nick Morgan, project manager for EPA Region IX. (916) 243-5831.

- Battery Dumping Pit - Leeds, Alabama. Lead contaminated soils were leached with a water/2% EDTA solution and the leachate was regenerated by sulfide precipitation. Contact Richard Travers, EPA Emergency Response Team. (201) 321-6677.

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# Technology Screening Guide for Treatment of CERCLA Soils and Sludges

## B.3 Soil Washing

### *Technology Description*

The soil washing process extracts contaminants from sludge or soil matrices using a liquid medium such as water as the washing solution. This process can be used on excavated soils that are fed into a washing unit. The washing fluid may be composed of water, organic solvents, water/chelating agents, water/surfactants, acids, or bases, depending on the contaminant to be removed. In contrast, in situ soil washing is performed on unexcavated soils and consists of injecting a solvent or surfactant solution to enhance the contaminant solubility, resulting in increased recovery of contaminants in the leachate or ground water (see B.4).

EPA's mobile extraction system uses water as the washing fluid. Contaminated soil enters the system through a feeder, where oversized nonsoil materials and debris that cannot be treated are removed with a coarse screen. The waste passes into a soil scrubber, where it is sprayed with washing fluid. Soil particles greater than 2 mm in diameter are sorted and rinsed, leave the scrubber, and are dewatered. The remaining soil enters a countercurrent chemical extractor, where additional washing fluid is passed countercurrent to the soil flow, removing the contaminants. The treated solids are then dewatered. The remainder of the process is a multistep treatment for removal of contaminants from the washing fluid prior to its recycling. Treatment is generally accomplished by conventional wastewater treatment systems depending on the type of contamination. See Table 6 for residuals management techniques.

A soil washing process developed by MTA Remedial Resources, Inc. (MTARRI) utilizes technology transfers from both the mining and enhanced oil recovery fields to simultaneously remove and concentrate the organic contaminants from soils. Release of contaminants from clay and sand is accomplished through alkaline and surfactant addition, which results in changing the interfacial tension. The treatment residues, detoxified soil, can be returned to the site and the treatment byproducts, concentrated organics, require either incineration, landfilling, or additional treatment for ultimate contaminant removal. This technology has been also demonstrated to remove metallic compounds of lead, cadmium, chromium, copper, and nickel. This technology is commercially available. Restoration of aquifers contaminated with aromatic, aliphatic, and/or organo-chlorides is accomplished using alkaline agents, surfactants, and biodegradable polysaccharides. The vendor claims that 5 tons of treatment residue is generated per 100 tons of soil treated.

*Status*: Two mobile units are commercially available. This technology is currently used at Department of Defense sites as a modified air stripper to treat volatiles. Two mobile units will be operational by the end of 1988.

Figures B.3-1 and B.3-2 illustrate soil washing systems, and Table B.3-1 is a technology restriction table.

*EPA Contact:*

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Superfund

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# The Superfund Innovative Technology Evaluation Program:

## Technology Profiles

SITE

SUPERFUND INNOVATIVE
TECHNOLOGY EVALUATION

# BIOTROL, INC.
## (Soil Washing System)

### TECHNOLOGY DESCRIPTION:

Soil washing is a volume reduction method for treating excavated soils and is applicable for soils which are predominantly sand and gravel. It is based on the principle that the contaminants are associated primarily with soil components finer than 200 mesh, including fine silts, clays, and soil organic matter.

The system uses attrition scrubbing to disintegrate or break up soil aggregates resulting in the liberation of the highly contaminated fine particles from the coarser sand and gravel (Figure 1). Furthermore, the surfaces of the coarser particles are scoured by abrasive action.

Volume reduction is achieved by separating the "washed" coarse material from the highly contaminated fine particles, oils, and wash water. The contaminated residual products can then be treated by other methods, including incineration, stabilization, and biodegradation.

Contaminated soil is first excavated and screened to remove oversize debris greater than one-half to one inch in diameter. Various segregation methods can be used to sort debris into categories for treatment and/or disposal. The debris-handling equipment is engineering on a case-by-case basis.

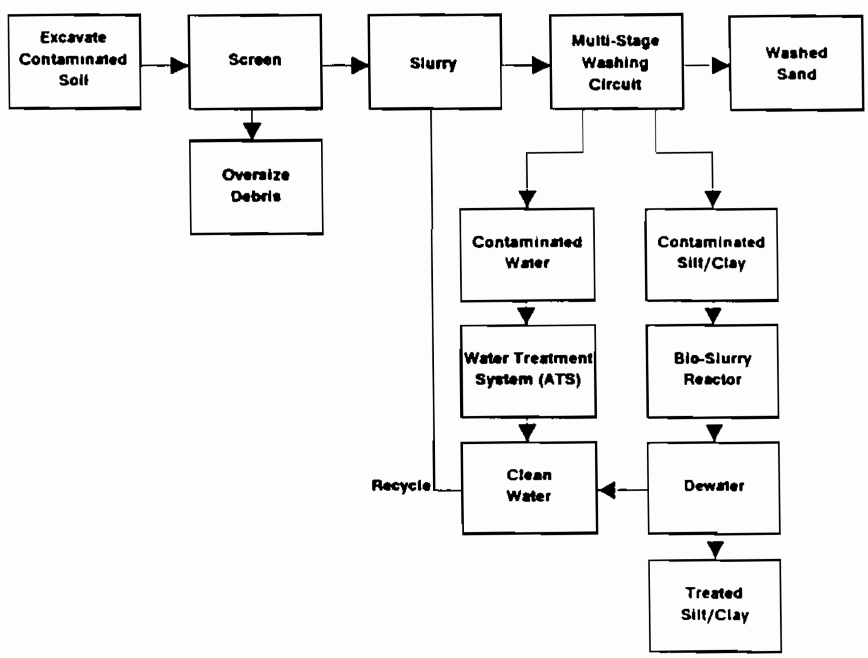


Figure 1. Biotrol soil treatment system process diagram.

Once the debris is removed, the contaminated soil is fed to the soil washing system, where it is slurried with water. It is screened again and fed to froth flotation where hydrophobic components (such as oil and certain clay minerals) are removed in the froth phase. The soil slurry then enters a multi-stage, countercurrent, attrition/classification circuit consisting of attrition scrubbing units, hydrocyclones, and spiral classifiers. The bulk of the soil is then discharged as the washed product.

The process water contains the highly contaminated fine particles as well as dissolved contaminants. The fine solids are dewatered prior to secondary treatment. Where biodegradation is feasible, the thickened fine particle slurry is treated in a low energy reactor consisting of three continuous stirred tanks in series. In the reactor, indigenous microorganisms can be amended with specific bacteria. For pentachlorophenol (PCP) contamination, a Flavobacterium species is used.

The clarified process water may also be treated biologically, if applicable, using a fixed-film bioreactor system. Again, indigenous and specific microorganisms are used to degrade dissolved organic contaminants.

## WASTE APPLICABILITY:

This technology was initially developed to clean soils contaminated with oil, pentachlorophenol, and creosote (polyaromatic hydrocarbons) from wood-preserving sites. It is also expected to be applicable to soils contaminated with petroleum hydrocarbons and pesticides.

## STATUS:

The soil washing system was operated successfully over a 2-year period at a wood treating site in Minnesota. During this time, biological treatment of the process water from soils washing was also successfully demonstrated. In 1989, Biotrol, Inc., added slurry biodegradation technology to treat the fine particle sludge generated by soil washing of soils contaminated by degradable, organic contaminants.

The SITE demonstration of the soil washing technology took place from September 25 to October 27, 1989 at the MacGillis & Gibbs Superfund site in New Brighton, Minnesota. The soil washing system used in the demonstration was a pilot-scale unit with a treatment capacity of 500 to 1,000 pounds per hour.

The soil washing process was operated continuously for two days on a soil contaminated with low levels of PCP (about 300 ppm PCP) and seven days on a high PCP level soil ( about 1,000 ppm PCP). All process water from soil washing was treated in a fixed-film bioreactor and recycled back to soil washing. A portion of the fine particle slurry from the high PCP soil washing test was treated in a pilot scale EIMCO Biolift Reactor supplied by EIMCO Process Equipment Company.

The Technology Evaluation Report will be available in May 1990.

## FOR FURTHER INFORMATION:

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# Technology Profile

Demonstration Program

SUPERFUND INNOVATIVE TECHNOLOGY EVALUATION

November 1989

## OZONICS RECYCLING CORPORATION
## (Soil Washing/Catalytic Ozone Oxidation)

### TECHNOLOGY DESCRIPTION:

The Excalibur/Ozonics technology is designed to treat soils with organic and inorganic contaminants. The technology is a two-stage process; the first stage extracts the contaminants from soil, and the second stage oxidizes contaminants present in the extract. The extraction is carried out using ultrapure water and ultrasound. Oxidation involves ozone, ultraviolet light, and ultrasound. The treatment products of this technology are decontaminated soil and inert salts.

A flow schematic of the system is shown in Figure 1. After excavation, contaminated soil is screened through a 1-inch screen. Soil particles retained on the screen are crushed using a hammermill and sent back to the screen. Soil particles passing through the screen are sent to a soil washer, where ultrapure water extracts the contaminants from the screened soil. Ultrasound is used as a catalyst to enhance soil washing. Typically, 10 volumes of water are added per volume of soil, which generates a slurry of about 10-20 percent solids. This slurry is conveyed to a solid/liquid separator, such as a centrifuge or cyclone, to separate the decontaminated soil from the contaminated water. The decontaminated soil can be returned to its original location or disposed of appropriately.

After the solid/liquid separation, any oil present in the contaminated water is recovered using an oil/water separator. The contaminated water is ozonated prior to oil/water separation to aid in oil recovery. Then, the water flows through a filter to remove any fine particles. After the particles are filtered out, the water flows through a carbon filter and a deionizer to reduce the contaminant load on the multichamber reactor. In the multichamber reactor, ozone gas is applied to the contaminated water, along with ultraviolet light and ultrasound. Ultraviolet light and ultrasound catalyze the oxidation of contaminants by ozone. The treated water (ultrapure water) flows out of the reactor to a storage tank and is reused to wash another batch of soil. If makeup water is required, additional ultrapure water is generated on-site by treating tap water with ozone and ultrasound.

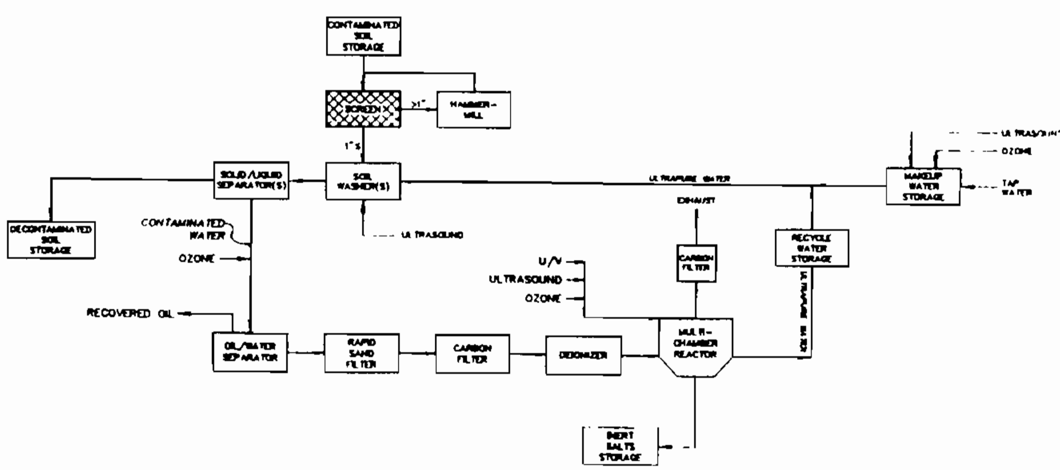


Figure 1. Excalibur/Ozonics treatment system flow diagram.

The treatment system is also equipped with a carbon filter to treat the off-gas from the reactor. The carbon filters are biologically activated to regenerate the spent carbon in-situ.

System capacities range from one cubic foot of solids per hour, with a water flow rate of one gallon per minute; to 27 cubic yards of solids per hour, with a water flow rate of 50 gallons per minute. The treatment units available for the demonstration can treat 1 to 5 cubic yards of solids per hour.

## WASTE APPLICABILITY:

This technology can be applied to soils, solids, sludges, leachates and ground water containing organics such as PCB, PCP, pesticides and herbicides, dioxins, and inorganics such as cyanides. The total contaminant concentrations could range from 1 ppm to 20,000 ppm for the technology to be effective. Soils and solids greater than 1-inch in diameter need to be crushed prior to treatment.

## STATUS:

Site selection to demonstrate this technology is underway.

## FOR FURTHER INFORMATION:

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# Superfund Treatability Clearinghouse Abstracts

## SUPERFUND TREATABILITY CLEARINGHOUSE ABSTRACT

### Treatment Process: Physical/Chemical - Soil Washing

***Media:*** Soil/Generic

***Document Reference:*** PEI Associates, Inc. "CERCLA BDAT SARM Preparation and Results of Physical Soils Washing Experiments (Final Report)." Prepared for U.S. EPA. Approximately 75 pp. October 1987.

***Document Type:*** EPA ORD Report Site

***Contact:***
Richard Traver, Staff Engineer
U.S. EPA, ORD
Woodbridge Avenue
Edison, NJ 08837
201-321-6677

***Site Name:*** Manufactured Waste (Non-NPL) Site Best Demonstrated Available Technology (BDAT)

***Location of Test:*** ORD - Edison, NJ

**BACKGROUND**: This study reports on the results of work preparing 30,000 lbs of SARM or synthetic analytical reference matrix, a surrogate soil containing a wide range of contaminants. It also reports the results of bench scale treatability experiments designed to simulate EPA's mobile soil washing system, where SARM samples were washed to determine the efficiency of using chelating reagent and surfactants to remove contaminants from the SARMs.

**OPERATIONAL INFORMATION**: SARMs were developed to support testing of various cleanup technologies in support of the Superfund BDAT program Superfund sites were surveyed to evaluate the type of soils present and the concentrations of contaminant in the soils. The final soil composition selected consists of 30% clay, 25% silt, 20% sand, 20% topsoil and 5% gravel. A prescribed list of chemicals were added to the soils. The contaminants include volatile and semi-volatile organics, chlorinated organic compounds and the metals Pb, Zn, Cd, As, Cu, Cr and Ni. Four different SARM formulations were prepared containing high and low levels of metals and organics. They will be used by the EPA in subsequent treatability studies.

Different solutions containing SARM samples were tested in bench scale shaker tests to determine the ability of a chelant (EDTA), a sufactact (TIDE) and plain water solvent to remove various contaminants from the fine and coarse fractions of soils. The degree of contamination in both the coarse and fine fraction was determined by TCLP tests and total waste analysis (SW-846, 3rd edition). A QA/QC discussion is contained in the report and a complete QA/QC plan is appended.

**PERFORMANCE**: After samples were treated on the bench scale shaker table the SARM soils were put through a wet sieve to separate fine from coarse materials and the fractions were analyzed using TCLP tests and total analysis. Tap water was as effective in removing the VOC as the other solutions. PH and temperature had very little effect on VOC reduction. The semi-volatile organics were removed slightly better by the 0.5% TIDE than plain tap water. A chelant concentration of 3 moles of EDTA to total metals was most effective in removing metals. Chelant reaction time for removal was 15 to 30 minutes. Arsenic and chromium showed the poorest removal efficiencies while Cd, Zn, Cu and Ni were easily chelated by EDTA. The soil is divided into three particle size classes > 2 mm, 2 mm to 250 μm and < 250 μm. The washes removed contaminants from the 2 larger classes of soils to levels below the proposed TCLP limits. These soil classes comprise 42% by weight of the SARM and could potentially be classified as non-hazardous and be returned to the site. The contaminated fines could be stabilized and treated further. This study revealed the SARM could be cleaned by soils washing and the contaminated soil volume could be reduced..

**CONTAMINANTS**:

| Treatability Group | CAS Number | Contaminants |
|---|---|---|
| W01-Halogenated Nonpolar Aromatic Compounds | 108-90-7 | Chlorobenzene |
| W03-Halogenated Phenols, Cresols, Ethers, and Thiols | 87-86-5 | Pentachlorophenol |
| W04-Halogenated Aliphatic Compounds | 107-06-2 | 1,2-Dichloroethane |
| | 127-18-4 | Tetrachloroethene |
| W07-Simple Nonpolar Aromatics and Heterocyclics | 100-42-5 | Styrene |
| | 1330-20-7 | Xylenes |
| | 100-41-4 | Ethylbenzene |
| W08-Polynuclear Aromatics | 120-12-7 | Anthracene |
| W09-Other Polar Organic Compounds | 117-81-7 | Bis(2-ethylhexyl)phthalate |
| | 67-64-1 | Acetone |
| W10-Non-Volatile Metals | 7440-50-8 | Copper |
| | 7440-02-0 | Nickel |
| | 7440-47-3 | Chromium |
| W11-Volatile Metals | 7439-92-1 | Lead |
| | 7440-66-6 | Zinc |
| | 7440-43-9 | Cadmium |
| | 7440-38-2 | Arsenic |

**NOTE: Quality assurance of data may not be appropriate for all uses.**

3/89-42 **Document Number: EUQW**

## SUPERFUND TREATABILITY CLEARINGHOUSE ABSTRACT

### Treatment Process: Physical/Chemical - Soil Washing/Chemical Extraction

***Media:*** Soil/Silty

***Document Reference:*** Assink, J.W. "Extractive Methods for Soil Decontamination, A General Survey and Review of Operational Treatment Installations." Apeldoorn, Netherlands. Technical Report. 13 pp. November 1985.

***Document Type:*** Contractor/Vendor Treatability Study

***Contact:*** U.S. EPA, ORD
HWERL
Woodbridge Avenue
Edison, NJ 08837-3579
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***Site Name:*** Ecotechniek BV (Non-NPL)

***Location of Test:*** Netherlands

**BACKGROUND**: The treatability study report provides a general overview of soil decontamination by extraction and reports on the field application of three specific different soil washing/solvent extraction systems. Each system is similar in design and removed contaminants from soil including crude oil and metals.

**OPERATIONAL INFORMATION**: The soil to be cleaned is mechanically pretreated to remove large objects such as pieces of wood, vegetation remains, concrete, stones, and drums, while hard clods of soil are reduced in size. The sieve residue may be cleaned separately. The pretreated soil is then mixed with an extracting agent such as acids, bases, surface active agents, etc. The primary purpose of this step is to transfer the contaminants to the extraction fluid, either as particles or as a solute.

The soil and the extracting agent are separated. The contaminants, the smaller soil particles (clay and silt particles) and the soluble components in the soil are generally carried off with the extraction agent. The soil undergoes subsequent washing with clean extracting agents and/or water to remove as much of the remaining extraction fluid as possible. The larger particles carried off with the extraction phase are separated as best as possible and, if required, undergo a subsequent washing with clean extracting agent. The contaminated extraction fluid is cleaned and can be re-used after the addition of chemicals.

**PERFORMANCE**: All types of contaminants may be removed from the soil by extraction if they can be dissolved in the extracting agent or dispersed in the extraction phase. Extraction is especially suitable for sandy soil, low in humus and clay content, because of the sand particles' (50-80 µm) relatively high settling velocity. Sludge residue from this process generally has to be disposed of. Currently, four installations for extractive cleaning of excavated soil are operational in the Netherlands. The operational soil washing installations have proven successful for removing cyanides; PNAs (polynuclear aromatics) and mineral oil; heavy metals; halogenated hydrocarbons and other contaminants with efficiencies exceeding 80% (see bottom table).

**CONTAMINANTS**:

Analytical data is provided in the treatability study report. The breakdown of the contaminants by treatability group is:

| Treatability Group | CAS Number | Contaminants |
|---|---|---|
| W07-Heterocyclics & Simple Aromatics | TOT-AR | Aromatic Hydrocarbons |
| W08-Polynuclear Aromatics | TOT-PAH | Total Polycyclic Aromatic Hydrocarbons |
| W11-Volatile Metals | 7439-92-1 | Lead |
| W12-Other Inorganics | 7440-66-6 | Zinc |
| W13-Other Organics | 57-12-5 | Cyanide |
| | TOX | Total organic halogens |
| | CRUDE | Crude Oil |

**Contaminant Removal Efficiency**

| Contaminant | Initial Concentration ppm | Final Concentration After Treatment | Removal Efficiency % (approximate) |
|---|---|---|---|
| CN (galvanic) | 450 | 15 | 94 |
| Zn | 1600-3000 | 300-500 | 83 |
| Cd | 66-125 | 5-10 | 92 |
| Ni | 250-890 | 85-95 | 66-89 |
| Pb | 100 | 25 | 75 |
| Aromatics | 240 | 41 | 81 |
| PNAs | 295 | 15 | 95 |
| Crude Oil | 79 | 2.3 | 97 |

NOTE: This is a partial listing of data. Refer to the document for more information.

**NOTE: Quality assurance of data may not be appropriate for all uses.**

3/89-10 **Document Number: EUTT**

# APPENDIX L.2

# SOIL STABILIZATION

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# Mobile Treatment Technologies for Superfund Wastes

# 3.0 IMMOBILIZATION

## Introduction

The method of waste treatment discussed in this section is described by terms such as stabilization, solidification, fixation and immobilization. In general, all of these terms refer to the process of adding materials that combine physically and/or chemically to decrease the mobility of the original waste constituents. The end result of this process is to retard further migration of contaminants. Because of the similarities among the terms listed above, they are all referred to in this section by one general term -- immobilization.

Immobilization is used for several purposes which include the following:

- o Improvement of waste handling characteristics,
- o Solidification of liquid phases and immobilization of any highly soluble components,
- o Reduction in the potential contact area between the waste and any liquids that may come in contact with the waste to minimize leaching potential, and
- o Detoxification of the waste.

The process of fixation can achieve the above objectives, but the application of a specific process is dependent upon the final disposal method to be used for the waste. Some applications include:

- o In situ immobilization - useful for reducing potential contaminant migration into groundwater without excavation,
- o Excavation and partial immobilization - useful for improving waste handling characteristics and solidifying liquid phases prior to disposal in a secure landfill,
- o Excavation and full immobilization - used to convert waste to a solid mass with more complete immobilization of soluble contaminants. Tests are required to demonstrate that such immobilization meets remedial action goals.

The applications above are listed in order of increasing cost. The cost is directly linked to the quantity of fixing agent (typically cement) used. Final disposal options for more complete immobilization may be less expensive than those for wastes that are partially immobilized. Disposal costs should be considered when determining the use of immobilization methods.

Portland cement is widely used for immobilization because of its ready availability. Pozzolanic materials such as fly ash may be available at a lower cost, but the regulations on land disposal of hazardous bulk liquids prohibit the use of materials such as fly ash that do not fully immobilize the waste. The use of a immobilization technique should be made only after the immobilization process has been tested on sample material and the chemical and physical properties of the solidified waste have been extensively tested to insure that contaminant immobilization is adequate. Vendors of immobilization processes will usually conduct pilot tests on sample material to ensure their process performs adequately.

Other immobilization techniques such as encapsulation in asphalt or glass are available. However, the vast majority of mobile immobilization systems are cement- or pozzolan-based. Hence only these types of immobilization are discussed in this section.

## Process Description

The equipment required for this treatment includes standard cement mixing and handling equipment which is widely available. The techniques of cement mixing and handling are well-developed and the process is reasonably tolerant of variations in the waste stream and/or soil matrix. However, modifications to the process include the use of more expensive cement types, and costly additives or coatings. In situ immobilization may require the use of special subsurface fixative injection equipment.

The key operation parameters include:

- o Fixative-to-waste ratio (usually 1 to 1),
- o Length of time for setting and curing (usually one to two days), and
- o Required structural integrity and minimized potential for leaching of the pollutants from the resultant solidified waste mass.

Immobilization procedures are quite mobile. Heavy equipment such as backhoes, specialized hydraulic augers, cement mixers and dump trucks are used for specific excavation, mixing and hauling needs. Many companies have developed specialized equipment such as injectors and augers that simultaneously inject cement and mix the matrix.

## Wastes Types Handled

Immobilization is well-suited for solidifying sludges and soils containing the following:

- o Heavy metals,
- o Inorganics such as sulfides,
- o Organics (generally no more than 20% by volume),
- o Asbestos, and
- o Solidified plastic, resins and latex.

Use of sodium silicates can reduce interference with dissolved metallic anionic species such as arsenate and borate.

Waste Restrictive Characteristics

The following constituents may interfere with the use of cement-based methods of immobilizing of hazardous constituents:

- o Fine organic particles such as silt, clay, lignite or other insoluble materials passing the No. 200 sieve. These particles can weaken cement bonds by coating large contaminants with a dust layer;
- o Elevated levels of organics such as solvents can interfere with setting and curing of cement-based fixatives. Some vendors have processes that can handle up to 100% organics, but 20 to 40% organics is a more typical maximum;
- o Soluble salts of many metals (i.e., manganese, tin, zinc, copper, lead) as well as the sodium salts of arsenate, borate, phosphate, iodate and sulfide. These salts interfere with the setting and curing of cement as well as reduce the ultimate strength of the product;
- o Sulfates which retard the setting of concrete as well as cause swelling due to the formation of calcium sulfoaluminate hydrate.

Required Onsite Facilities/Capabilities

Because heavy equipment will be used on site, project managers must consider the required access roads, adequate safety during operation and decontamination of equipment.

As the operation is progressing, quality control should be incorporated to insure that proper mixing ratios and proper solid consistency are achieved, thus minimizing the leaching potential of the final fixed product. This may require onsite (or nearby offsite) testing using a field laboratory. Chemical storage facilities would also need to be provided.

Environmental Impacts

The following environmental concerns are associated with immobilization technologies:

- o Sidestreams generated in this process include leachate water which may be produced as a result of the drying process. However, the volume is usually minimal and storage and later disposal may address this problem.
- o The alkalinity of cement drives off ammonium ion as ammonia gas. Therefore, gas monitoring and collection may be necessary with wastes containing ammonium ion.
- o Site-specific requirements that may hinder implementation include space limitations for disposal (immobilized waste volume may double) or an acidic in situ leaching medium.

- o Applicable regulatory requirements may include RCRA requirements pertaining to treatment of hazardous waste and RCRA delisting requirements if disposal as a sanitary waste is desired.
- o The movement of treated wastes off site may significantly degrade existing roads, create a dust problem, and impact nearby residents due to the noise and inconvenience of heavy equipment nearby.
- o Prevention of offsite transfer of contaminants by vehicles should include decontamination by high pressure steam prior to any vehicle departing the site.

Costs

Information supplied by vendors (Superfund Treatment Technologies - A Vendor Inventory, EPA, 1986) typically estimate the cost of cement-based treatment at $0.10 to $0.35 per gallon or $25 to $150 per cubic yard. The highest estimated cost is quoted by a vendor principally treating radioactive wastes. The highest cost method of immobilization is total encapsulation of waste. Guidelines to the costs for treatment are presented in Table 3-1.

In most cases, the desired method of disposal will dictate the degree, and therefore, the cost of treatment. For landfilling, cost of disposal is usually a function of the bulk of materials--the greater the bulk, the higher the cost. Use of Portland cement may produce an increase in bulk of 100 to 250 percent though several vendors have processes that produce smaller volume increases. Cost of disposal in a landfill will increase accordingly. Conversely, thorough immobilization of the waste so that it can be delisted may permit disposal in a sanitary landfill instead of a hazardous waste landfill. This would result in substantial savings in the cost of landfilling.

Commercial Applications

Few vendors are willing to identify the type or amount of additives employed in immobilization treatments. The type and amount of additives vary depending on the wastes being treated and in many cases, information concerning these additives is proprietary. The vendors universally prefer to determine treatability after sampling the wastes and subjecting the samples to laboratory testing. Many vendors restrict their activities to particular waste types.

A summary of information supplied by vendors for the Superfund Treatment Technologies - A Vendor Inventory (EPA, 1986) is presented in Table 3-1.

Company contacts and addresses can be found in the appendix.

TABLE 3.1

MOBILE IMMOBILIZATION PROCESSES

| Company | Type of Mobil Equipment | Processing Rate | In Situ Capability | Types of Wastes Preferred | Fixation Agent | Time to Mobilize | Guideline Cost of Treatment | End Product |
|---|---|---|---|---|---|---|---|---|
| Chemfix Technologies, Inc. Kenner, LA | Mixer, materials handling equip., excavations | 50 to 800 gpm | No | Aqueous, <60% solids | Proprietary | 2 weeks | $20 to $50/ton | A friable clay-like product |
| Chemical Waste Management Riverdale, IL | Conventional heavy equipment, mixers, materials handling equipment | Varies | No | Solids, sludges, liquids | Varies | 2 days | - - - - - | Unstated |
| Envirite Field Services Plymouth Meeting, PA | Proprietary dewatering and chemical injection equipment | 25,000 to 90,000 gpd | Yes | Solids, sludges, liquids | Unspecified | < 1 day | $0.10 to $0.25/gal | Stabilized landfillable material |
| Hazcon Inc. Katy, TX | Proprietary mixing, dredging and conveyor equipment | 5 to 60 cy/hr. | No | Organics up to 100 % oily sludges, metals | Cement and proprietary agents | 12 hours | $65 to $150/cy | Solid, 1,000 - 5,000 psi compr. strength, permeability $10^{-7}$, |
| Solidtek Morrow, GA | Proprietary special purpose machinery | 5 to 200 cy/hr. | No | No restrictions | Unspecified | 3-20 days | - - - - - | Varies according to specifications and method of ultimate disposal |
| Velsicol Chemical Corp. Memphis, TN | Mixers, excavators, bulldozers | Varies | Yes | Organics up to 45%, sludges | Cement and unspecified chemicals | 3-4 weeks | $0.15 to $0.50/gal | Stabilized, heavy clay like substance |
| Westinghouse Hittman Nuclear Columbia, MD | Proprietary compacting, mixing, and silo equipment | Batch: 150 to 300 gph<br>Continuous: 5 to 15 gpm | No | Liquids, semi-solids | Cement | 1-2 weeks | $1350 - $2200/cy* | Solidified mass with high structural integrity |
| ATW/Caldweld Santa Fe Springs, CA | Custom augering, mixing and injection equipment with full in situ monitoring systems | 100-150 cy/hr. | Yes | Solids and soils | Fixation oxidation, precipitation, and biological agents may be injected | 1-2 weeks | - - - - - | Stabilized or solidified mass in subsurface |

* Stated costs of treatment is for radioactive wastes. No costs quoted for hazardous waste.

United States Environmental Protection Agency

Office of Solid Waste and Emergency Response Washington DC 20460

Office of Research and Development Washington DC 20460

Superfund

EPA 540 5-89 013 Nov 1989

EPA

# The Superfund Innovative Technology Evaluation Program:

## Technology Profiles

SITE

SUPERFUND INNOVATIVE TECHNOLOGY EVALUATION

# CHEMFIX TECHNOLOGIES, INC.
# (Solidification/Stabilization)

## TECHNOLOGY DESCRIPTION:

This solidification/stabilization process is an inorganic system in which soluble silicates and silicate setting agents react with polyvalent metal ions, and certain other waste components, to produce a chemically and physically stable solid material. The treated waste matrix displays good stability, a high melting point, and a friable texture. The matrix may be similar to soil or rigid depending upon the water content of the feed waste.

The feed waste is first blended in the reaction vessel (Figure 1) with certain reagents, which are dispersed and dissolved throughout the aqueous phase. The reagents react with polyvalent ions in the waste. Inorganic polymer chains (insoluble metal silicates) form throughout the aqueous phase and physically entrap the organic colloids within the microstructure of the product matrix.

The water-soluble silicates then react with complex ions in the presence of a siliceous setting agent, producing amorphous, colloidal silicates (gels) and silicon dioxide, which acts as a precipitating agent. Most of the heavy metals in the waste become part of the silicate. Some of the heavy metals precipitate with the structure of the complex molecules. A very small percentage (estimated to be less than one percent) of the heavy metals precipitates between the silicates and is not chemically immobilized.

Since some organics may be contained in particles larger than the colloids, all of the waste is pumped through processing equipment, creating sufficient shear to emulsify the organic constituents. Emulsified organics are then solidified and discharged to a prepared area, where the gel continues to set. The resulting solids, though friable, encase any organic substances that may have escaped emulsification.

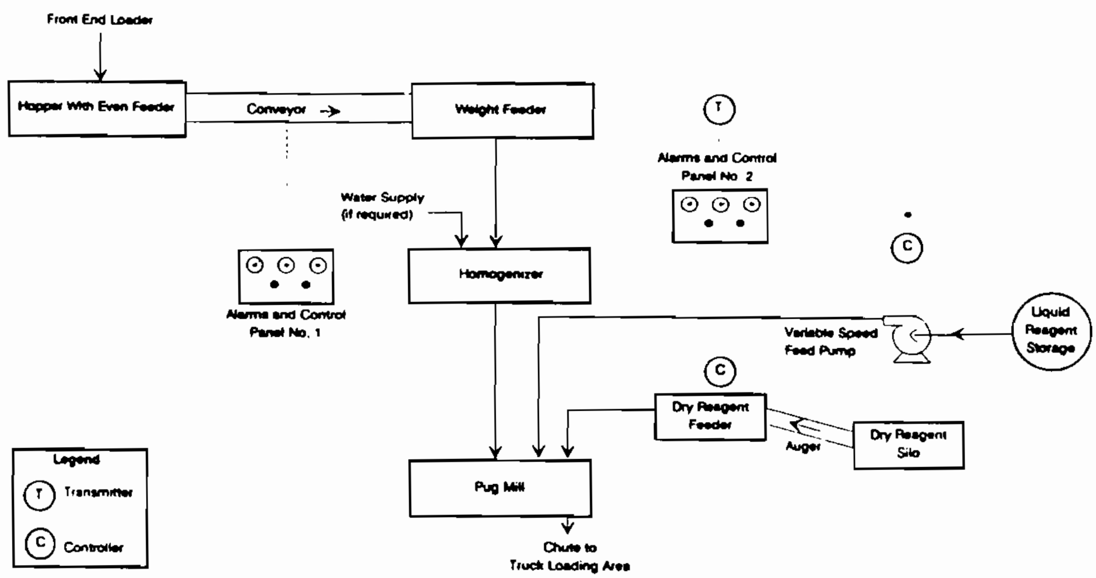


Figure 1. High solids handling system block process flow diagram.

The system can be operated at 5 to 80 percent solids in the waste feed; water is added for drier wastes. Portions of the water contained in the wastes are involved in three reactions after treatment: (1) hydration, similar to that of cement reactions; (2) hydrolysis reactions; and (3) equilibration through evaporation. There are no side streams or discharges from this process. The process is applicable to electroplating wastes, electric arc furnace dust, and municipal sewage sludge containing heavy metals such as aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, iron, lead, manganese, mercury, nickel, selenium, silver, thallium, and zinc.

## WASTE APPLICABILITY:

This technology is suitable for contaminated soils, sludges, and other solid wastes. It can also be used for base, neutral, or acid extractable organics of high molecular weight, such as refinery wastes, creosote, and wood-treating wastes.

## STATUS:

The technology was demonstrated in March 1989 at the Portable Equipment Salvage Co. site in Clackamas, Oregon. Preliminary results are available in a Demonstration Bulletin (October 1989). A single draft report describing the demonstration and future application of this technology has been completed and is under review. This final demonstration report will be completed in early 1990.

## DEMONSTRATION RESULTS:

- The Chemfix Technology was effective in reducing the concentrations of lead and copper in the extracts from the Toxicity Characteristic Leaching Procedure (TCLP). The concentrations in the extracts from the treated wastes were 94 percent to 99 percent less than those from the untreated wastes. Total lead concentrations in the raw waste approached 14 percent.
- The volume increase in the excavated waste material as a result of treatment varied from 20 to 50 percent.
- The results of the tests for durability were very good. The treated wastes showed little or no weight loss after 12 cycles of wetting and drying or freezing and thawing.
- The unconfined compressive strength (UCS) of the wastes varied between 27 and 307 psi after 28 days. Permeability decreased more than one order of magnitude.
- The air monitoring data suggest that there was no significant volatilization of PCBs during the treatment process.

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# HAZCON, INC.
# (Solidification/Stabilization)

## TECHNOLOGY DESCRIPTION:

This treatment technology immobilizes contaminants in soils by binding them into a concrete-like, leach-resistant mass. The technology mixes hazardous wastes, cement, water, and an additive called Chloranan that encapsulates organic molecules.

Contaminated soil is excavated, screened for oversized material, and fed to a mobile field blending unit (Figure 1). The unit consists of soil and cement holding bins, a Chloranan feed tank, and a blending auger to mix the waste and pozzolanic materials (Portland cement, fly ash, or kiln dust). Water is added as necessary, and the resultant slurry is allowed to harden before disposal. The treated output is a hardened, concrete-like mass that immobilizes the contaminants. For large volumes of waste, larger blending systems are available.

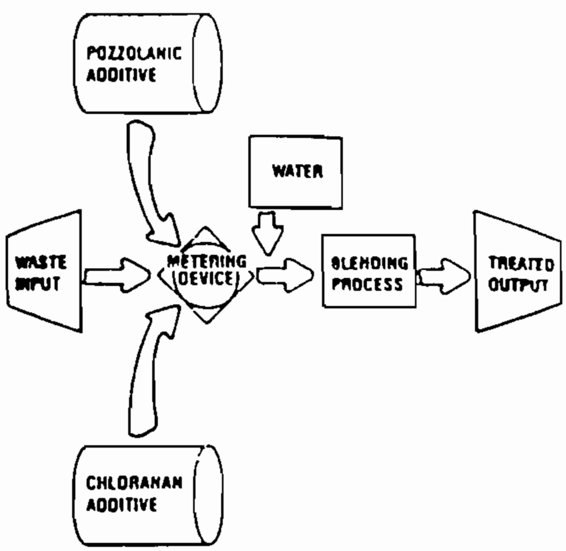


Figure 1. Solidification/stabilization process diagram.

## WASTE APPLICABILITY:

This technology is suitable for soils and sludges contaminated with organic compounds, heavy metals, oil and grease.

## STATUS:

The technology was demonstrated in October 1987 at a former oil reprocessing plant in Douglassville, Pennsylvania. The site contained high levels of oil and grease, volatile and semivolatile organics, PCBs, and heavy metals. A Technology Evaluation Report (September 1988) and Application Analysis Report (May 1990) describing the completed demonstration are available. A report on long-term monitoring will be completed by early 1990.

## DEMONSTRATION RESULTS:

The comparison of the soil 7-day, 28-day, 9 month, and 22-month sample test results are generally favorable. The physical test results were very good, with unconfined compressive strength between 220 to 1570 psi. Very low permeabilities were recorded, and the porosity of the treated wastes was moderate. Durability test results showed no change in physical strength after the wet/dry and freeze/thaw cycles. The waste volume increased by about 120%. By using less stabilizer, it is possible to reduce volume increases, but lower strengths will result. There is an inverse relationship between physical strength and the waste organic concentration.

The results of the leaching tests were mixed. The TCLP results of the stabilized wastes were very low; essentially all values of metals, volatile organics and semivolatile organics were below 1 ppm. Lead leachate concentrations dropped by a factor of 200 to below 100 ppb.

Volatile and semivolatile organic concentrations, however, did not change from the untreated soil TCLP. Oil and grease concentrations were greater in the treated waste TCLPs than in the untreated waste, from less than 2 ppm up to 4 ppm.

## APPLICATIONS ANALYSIS SUMMARY:

- The process can solidify contaminated material with high concentrations (up to 25%) of organics. However, organic contaminants, including volatiles and base/neutral extractables, were not immobilized to any significant extent.
- Heavy metals are immobilized. In many instances, leachate reductions were greater than 100 fold.
- The physical properties of the treated waste exhibit high unconfined compressive strengths, low permeabilities, and good weathering properties.
- Treated soils undergo volumetric increases.
- The process is economical, with costs expected to range between approximately $90 and $120 per ton.

## FOR FURTHER INFORMATION:

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# INTERNATIONAL WASTE TECHNOLOGIES/GEO-CON, INC.
## (In Situ Solidification/Stabilization Process)

## TECHNOLOGY DESCRIPTION:

This in situ solidification/stabilization technology immobilizes organic and inorganic compounds in wet or dry soils, using reagents (additives) to produce a cement-like mass. The basic components of this technology are: (1) Geo-Con's deep soil mixing system (DSM), a system to deliver and mix the chemicals with the soil in situ, and (2) a batch mixing plant to supply the International Waste Technologies' (IWT) proprietary treatment chemicals (Figure 1).

The proprietary additives generate a complex, crystalline, connective network of inorganic polymers. The structural bonding in the polymers is mainly covalent. The process involves a two-phased reaction in which the contaminants are first complexed in a fast-acting reaction, and then in a slow-acting reaction, where the building of macromolecules continues over a long period of time. For each type of waste, the amount of additives used varies and must be determined.

The DSM system involves mechanical mixing and injection. The system consists of one set of cutting blades and two sets of mixing blades attached to a vertical drive auger, which rotates at approximately 15 rpm. Two conduits in the auger are used to inject the additive slurry and supplemental water. Additive injection occurs on the downstroke; further mixing takes place upon auger withdrawal. The treated soil columns are 36 inches in diameter, and are positioned in an overlapping pattern of alternating primary and secondary soil columns.

## WASTE APPLICABILITY:

The IWT technology can be applied to soils, sediments, and sludge-pond bottoms contaminated with organic compounds and metals. The technology has been laboratory-tested on soils containing PCBs, pentachlorophenol, refinery wastes, and chlorinated and nitrated hydrocarbons.

The DSM system can be used in almost any soil type; however, mixing time increases with fines. It can be used below the water table and in soft rock formations. Large obstructions must be avoided.

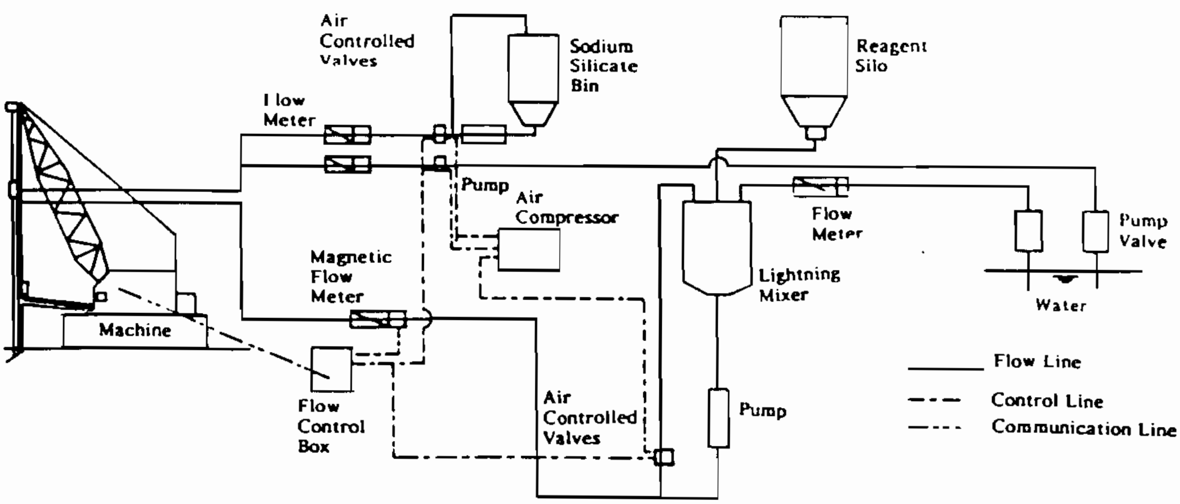


Figure 1. In-situ stabilization batch mixing plant process diagram.

## STATUS:

The Site Program demonstration took place at a PCB-contaminated site in Hialeah, Florida, in April 1988. Two 10 x 20-foot test sectors of the site were treated -- one to a depth of 18 feet, and the other to a depth of 14 feet. Ten months after the demonstration, long-term monitoring tests were performed on the treated sectors. The Technology Evaluation Report is available. The Applications Analysis Report and long-term monitoring results are scheduled to be published in January 1990.

## DEMONSTRATION RESULTS:

- Based on TCLP leachate analysis, the process appears to immobilize PCBs. However, because PCBs did not leach from most of the untreated soil samples, the immobilization of PCBs in the treated soil could not be confirmed.

- Sufficient data were not available to evaluate the performance of the system with regard to metals or other organic compounds.

- The bulk density of the soil increased 21% after treatment. This increased the volume of treated soil by 8.5% and caused a small ground rise of one inch per treated foot of soil.

- The unconfined compressive strength (UCS) of treated soil was satisfactory, with values from 300 to 500 psi.

- The permeability of the treated soil was satisfactory, decreasing four orders of magnitude compared to the untreated soil, or $10^{-6}$ and $10^{-7}$ compared to $10^{-2}$ cm/sec.

- The wet/dry weathering test on treated soil was satisfactory. The freeze/dry weathering test of treated soil was unsatisfactory.

- The microstructural analysis, scanning electron microscopy (SEM), optical microscopy, and x-ray diffraction (XRD), showed that the treated material was dense, non-porous, and homogeneously mixed.

- The Geo-Con DSM equipment operated reliably.

## APPLICATIONS ANALYSIS SUMMARY:

This technology was demonstrated at a site composed primarily of unconsolidated sand and limestone. The following conclusions were reached:

- Microstructural analyses of the treated soils indicated a potential for long-term durability. High unconfined compressive strengths and low permeabilities were recorded.

- Data provided by IWT indicate some immobilization of volatile and semivolatile organics. However, this may be due to organophilic clays present in the IWT reagent. There are insufficient data to confirm this immobilization.

- Performance data are limited outside of SITE demonstrations. The developer modifies the binding agent for different wastes. Treatability studies should be performed for specific wastes.

- The process is economic: $194 per ton for the 1-auger machine used in the demonstration; $110 per ton for a commercial 4-auger operation.

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## S.M.W. SEIKO, INC.
## (In Situ Solidification/Stabilization)

### TECHNOLOGY DESCRIPTION:

The Soil-Cement Mixing Wall (S.M.W.) technology involves the in-situ fixation stabilization and solidification of contaminated soils. Multi-axis overlapping hollow stem augers (Figure 1) are used to inject solidification/stabilization (S/S) agents and blend them with contaminated soils in-situ. The augers are mounted on a crawler-type base machine. A batch mixing plant and raw materials storage tanks are also involved. The machine can treat 90 to 140 cubic yards of soil per 8-hour shift at depths up to 100 feet.

The product of the in-situ S/S technology is a monolithic block down to the treatment depth. The volume increase ranges from 10 to 30 percent, depending on the nature of the soil matrix and the amount of fixation reagents and water required for treatment.

### WASTE APPLICABILITY:

This technology is applicable to soils contaminated with metals and semi-volatile organic compounds (pesticides, PCBs, phenols, PANs, etc.).

The technique has been used in mixing soil cement or chemical grout for more than 18 years on various construction applications, including cutoff walls and soil stabilization.

### STATUS:

This project was accepted into the SITE Demonstration Program in June 1989. Site selection is currently underway.

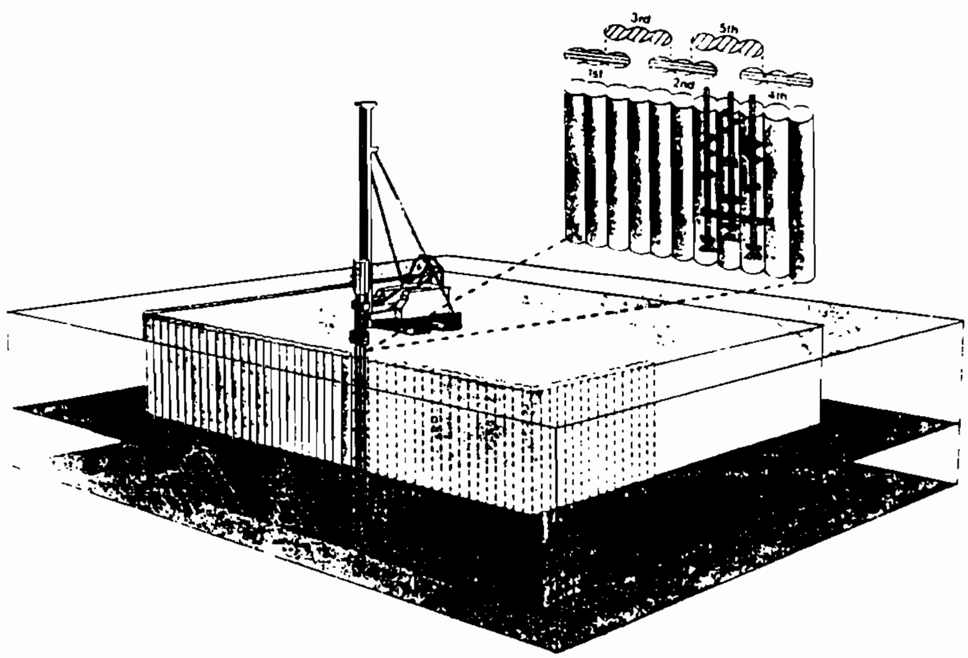


Figure 1. Soil cement mixing in-placed wall.

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# SILICATE TECHNOLOGY CORPORATION
# (Solidification/Stabilization with Silicate Compounds)

## TECHNOLOGY DESCRIPTION:

This solidification/stabilization technology uses silicate compounds and can be used as two separate technologies: (1) one that fixes and solidifies organics and inorganics contained in contaminated soils and sludges; and (2) another that removes organics from contaminated water. For soils and sludges, a proprietary reagent, FMS silicate, selectively adsorbs organic contaminants before the waste is mixed with a cement-like material to form a high-strength, non-leaching cement block (monolith). For water, the same reagent (FMS silicate) is used in conjunction with granular activated carbon to remove organics from the groundwater. The resulting waste material is then solidified by the first technology.

In this combined technology, the type and dose of reagents depend on the waste characteristics. Treatability studies and site investigations are conducted to determine reagent formulations for each site. The process begins with pretreating contaminated waste material. Coarse material is separated from fine material (Figure 1) and sent through a shredder, which cuts the material to the size required for the solidification technology. The waste is then loaded into a batch plant, where the FMS silicate is applied. The waste is weighed, and the proportional amount of FMS silicate is added. This mixture is conveyed to a concrete mixing truck, pug mill or other mixing equipment where water is added and the mixture is thoroughly blended. The treated material is then placed in a confining pit on-site for curing or cast into molds for transport and disposal off-site.

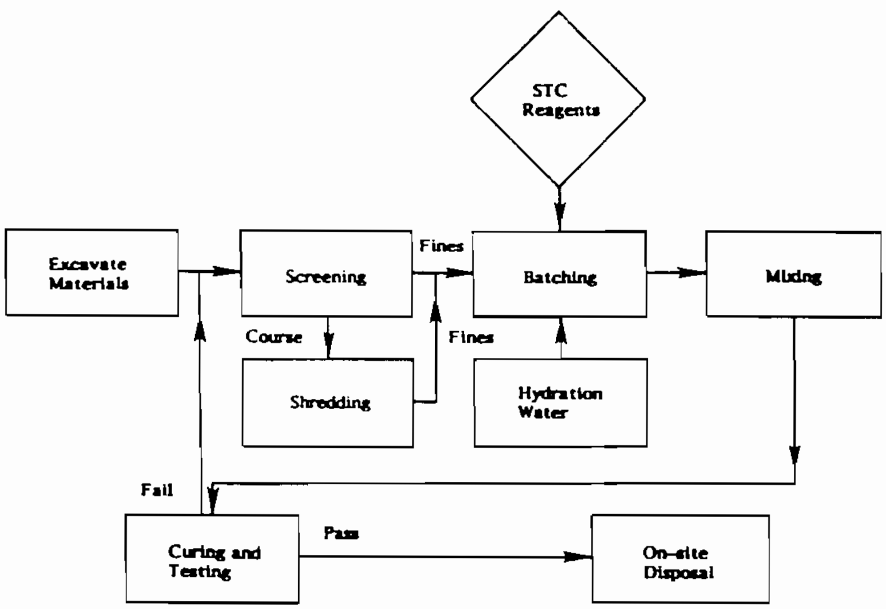


Figure 1. Contaminated soil process flow diagram.

A self-contained mobile filtration pilot facility is used to treat organic-contaminated ground water. Reagents aid in removing high molecular weight organics; granulated activated carbon is used to remove low molecular weight organics. The contaminated water is passed through a column filter containing the reagent. The high molecular weight organics are separated from the water in this step. The effluent from this column filter is then passed through a second column filter containing granulated activated carbon for removing low molecular weight organics.

## WASTE APPLICABILITY:

This technology can be applied to soils and sludges to metals, cyanides, fluorides, arsenates, ammonia, chromates, and selenium in unlimited concentrations. Higher weight organics in groundwater, soils, and sludges -- including halogenated, aromatic, and aliphatic compounds -- can also be treated by this process. However, the process is not as successful on low molecular weight organics such as alcohols, ketones and glycols and volatile organics.

## STATUS:

A demonstration of this combined technology should occur between December 1989 and August 1990 at the Kaiser Steel site in Fontana, California.

## FOR FURTHER INFORMATION:

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# Technology Profile

Demonstration Program

SITE
SUPERFUND INNOVATIVE TECHNOLOGY EVALUATION

November 1989


## SOLIDITECH, INC.
## (Solidification/Stabilization)

### TECHNOLOGY DESCRIPTION:

This solidification/stabilization process immobilizes contaminants in soils and sludges by binding them in a concrete-like, leach-resistant matrix.

Contaminated waste materials are collected, screened to remove oversized material, and introduced to the batch mixer (Figure 1). The waste material is then mixed with: (1) water, (2) Urrichem -- a proprietary chemical reagent, (3) proprietary additives, and (4) pozzolanic material (flyash), kiln dust, or cement (cement was used for the demonstration). Once thoroughly mixed, the treated waste is discharged from the mixer.

The treated waste is a solidified mass with significant unconfined compressive strength, high stability, and a rigid texture similar to that of concrete.

### WASTE APPLICABILITY:

This technology is intended for treating soils and sludges contaminated with organic compounds, metals, inorganic compounds, and oil and grease. Batch mixers of various capacities are available to treat different volumes of waste.

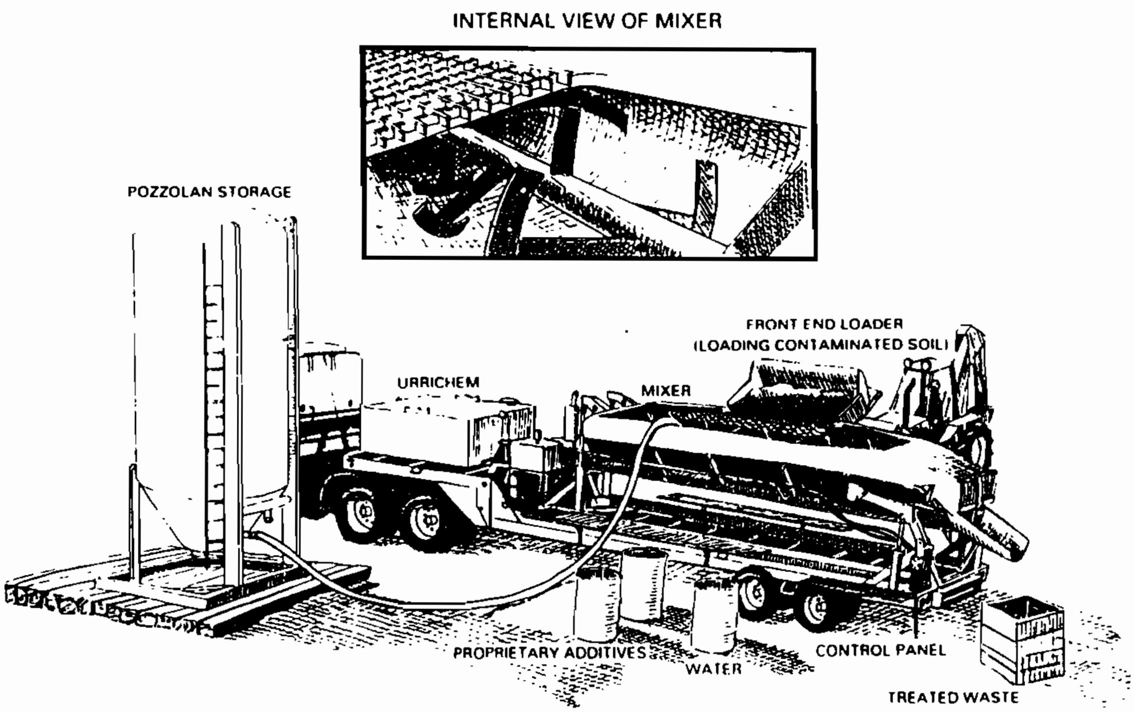


Figure 1. Soliditech processing equipment.

## STATUS:

The Soliditech process was demonstrated in December 1988 at the Imperial Oil Company/Champion Chemical Company Superfund site in Morganville, New Jersey. This location formerly contained both chemical processing and oil reclamation facilities. Wastes treated during the demonstration were soils, a waste pile, and wastes from an old storage tank. These waste were contaminated with petroleum hydrocarbons, PCBs, other organic chemicals, and heavy metals.

## DEMONSTRATION RESULTS:

Key findings from the Soliditech demonstration are summarized below:

- Chemical analyses of extracts and leachates showed that heavy metals present in the untreated waste were immobilized.
- The process solidified both solid and liquid wastes with high organic content (up to 17%) as well as oil and grease.
- Volatile organic compounds in the original waste were not detected in the treated waste.
- Physical test results of the solidified waste samples showed: (1) unconfined compressive strengths ranged from 390 to 860 psi; (2) very little weight loss after 12 cycles of wet/dry and freeze/thaw durability tests; (3) low permeability of the treated waste; and (4) increased density after treatment.
- The solidified waste increased in volume by an average of 22 percent. The bulk density of the waste material increased by approximately 35 percent due to solidification.
- Semivolatile organic compounds (phenols) were detected in the treated waste and the TCLP extracts from the treated waste, but not in the untreated waste or its TCLP extracts. The presence of these compounds is believed to result from chemical reactions in the waste treatment mixture.
- Oil and grease content of the untreated waste ranged from 2.8 to 17.3 percent (28,000 to 173,000 ppm). Oil and grease content of the TCLP extracts of the solidified waste ranged from 2.4 to 12 ppm.
- The pH of the solidified waste ranged from 11.7 to 12.0. The pH of the untreated waste ranged from 3.4 to 7.9.
- PCBs were not detected in any extracts or leachates of the treated waste.
- Visual observation of solidified waste showed dark inclusions approximately 1 mm in diameter. Ongoing microstructural studies are expected to confirm that these inclusions are encapsulated wastes.

A Technology Evaluation Report is scheduled for publication in November 1989. An Applications Analysis Report will be available in early 1990.

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EPA/540/2-89/001
August 1989

Superfund

# Superfund Treatability Clearinghouse Abstracts

## SUPERFUND TREATABILITY CLEARINGHOUSE ABSTRACT

**Treatment Process:** **Immobilization - Cement Solidification**

***Media:*** Soil/Sand and Silt

***Document Reference:*** Firestone Resource, Inc. (Three Documents). "Soil Stabilization Pilot Study, United Chrome NPL Site, Corvallis, Oregon" and "Quality Assurance/Quality Control Plan United Chrome NPL Site Pilot Study" and "Health and Safety Program, United Chrome NPL Site Pilot Study." Technical reports prepared for U.S. EPA - Region 10 and DEP of Oregon. Approximately 45 pages. February 1987.

***Document Type:*** Contractor/Vendor Treatability Study

***Contact:*** John Barich
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206-442-8562

***Site Name:*** United Chrome, OR (NPL)

***Location of Test:*** Corvallis, OR

**BACKGROUND:** This document is a project plan for a pilot study at the United Chrome NPL site, Corvallis, Oregon and includes the health and safety and quality assurance/quality control plans. The plan reports results of a bench-scale study of the treatment process as measured by the Toxicity Characteristic Leaching Procedure (TCLP) test. The purpose of this study, conducted by Firestone Resources Inc., was to evaluate the effectiveness of soil stabilization technologies to reduce the leaching of heavy metals and to "pretreat" contaminated soils for subsequent off-site management.

**OPERATIONAL INFORMATION:** The data available from this 1985 stüdy are bench scale data involving 1400 pounds of soil from the Western Processing NPL site which was generated to support the proposal/work plan for the United Chrome NPL site. Three commercial soil stabilization vendors submitted to EPA 14 stabilized soil cylinders representing the "best achievable performance" of their technology. One of the bench-tests was performed by Firestone Resources, Inc. (FRI). The FRI treatment process consisted of using an inorganic polymer with cement that was applied to the excavated site soil. The extraction protocol used in the analysis was TCLP, and both treated and untreated soil were analyzed. Region 10 confirmed with these bench tests that soil stabilization as performed by these vendors is effective in reducing leach rate of heavy metals in sands/silt matrices with little organic co-contamination.

Contained in the document is site description data, work plan description data, and a proposed sample analysis plan.

The QA/QC plan for the pilot test is an attachment to the first volume of the study, and is extensive in the referenced methodology.

**PERFORMANCE:** The bench tests indicated reduction of heavy metal leachate concentrations to low levels as measured by TCLP procedures. The results of the FRI test are shown in the bottom table. Through groundwater modeling using as inputs the reductions in leachate strength as measured by these tests, soils stabilization was demonstrated to be capable of achieving water quality criteria at the Western Processing test site. Pilot demonstration of this treatment process is planned for the United Chrome NPL site.

**CONTAMINANTS:**

| Treatability Group | CAS Number | Contaminants |
|---|---|---|
| W10-Nonvolatile Metals | 7440-39-3 | Barium |
| | 7440-47-3 | Chromium |
| | 7440-50-8 | Copper |
| | 7440-02-0 | Nickel |
| W11-Volatile Metals | 7440-43-9 | Cadmium |
| | 7439-92-1 | Lead |
| | 7440-66-6 | Zinc |

**TCLP Leachates From the Western Processing**

| Contaminant | Soil Leachate | Stabilized Soil | Percent Reduction |
|---|---|---|---|
| Zinc | 123,700 | 38.5 | 99.97% |
| Lead | 12,115 | 15.5 | 99.87% |
| Barium | 1,165 | ND | 100.00% |
| Copper | 227.5 | 32 | 85.93% |
| Nickel | 107 | ND | 100.00% |
| Chromium | 50 | 35 | 30.00% |
| Cadmium | 17 | 0.4 | 97.65% |

Notes:
a) All concentration in µg/l
b) ND - Not Detectable
c) This is a partial listing of data. Refer to the document for more information.

**NOTE: Quality assurance of data may not be appropriate for all uses.**

**3/89-874** **Document Number: EUXT**

# SUPERFUND TREATABILITY CLEARINGHOUSE ABSTRACT

## Treatment Process: Immobilization - Flyash Solidification

***Media:*** Sludge/Metal Finishing

***Document Reference:*** VeriTec Corp. Case Study, Hazardous Waste Management Utilizing Lime. Paper presented at the Annual Meeting of the National Lime Association, Phoenix, Arizona. 13 pp. April 9, 1987.

***Document Type:*** Conference Paper

***Contact:*** Andre DuPont
National Lime Association
3601 North Fairfax Drive
Arlington, VA 22201
703-243-LIME

***Site Name:*** VeriTec Corp. (Non-NPL)

***Location of Test:*** Knoxville, TN

**BACKGROUND**: This report presents the results of treating a plating sludge having high levels of Cu, Ni and Cr with a lime fly ash additive. The pozzolonic reaction solidified the sludge. The results of various leaching tests are presented and discussed. An economic analysis suggests that the mixture used was more cost effective than other types of solidifying agents and processes. Various additive sludge ratios are recommended and a conceptual system design along with costs is presented.

**OPERATIONAL INFORMATION**: The sludge that was investigated was a Cu-Ni-Cr hydroxide sludge from alkaline pH precipitation of a plating-rinse wastewater. The untreated sludge contains 35 g/kg of Cu, 65g/kg Ni and 72 g/kg of Cr. Sludge density is 1.133 g/cc. Lab tests revealed that solidification was feasible and that the solidified samples displayed considerable unconfined compressive strength. The structural strength was reported to be between 100-125 psi. Lab tests were followed with field tests to determine the effect of leaching on the solid samples. At 21 days treated samples were subject to the EPA-RCRA EP toxicity procedures, deionized water leaching procedures, and the Multiple Extraction Procedure (MEP) leaching test. Detailed explanation of the leaching procedures are given along with methods of analysis used to determine heavy metal concentrations. No QA/QC information is contained in the report.

**PERFORMANCE**: Laboratory simulation studies revealed that the fixation process could reduce the EP toxicity. EP toxicity tests for Cr, Ni and Cu with initial concentrations of 73.0, 65.6 and 22.0 mg/l, respectively, were reduced by treatment to 2.9, 1.0 and 1.0 mg/l, respectively. Field tests reveal that levels of Ni, Cr and Cu can all be reduced by the fixation process. The following tables show results from the various leaching tests. Cyanide (CN) is not used in the plant, however, CN was found at 0.13 and 0.05 ppm in the raw sludge leachate samples. CN was < 0.01 in all treated sludge samples showing this fixation process also retards low level leaching of cyanides. Total chromium was reduced from 22 to .02 - .05 ppm in one set of samples and from 3.5 ppm to 0.4 - 0.1 ppm in another set of samples. Nickel was reduced from 87 to 0.01 ppm with treatment. The authors state that they believe the wastes no longer violate hazardous waste criteria and recommend that the treated wastes be delisted.

An economic analysis of the costs associated with fixing one ton of sludge using a 1:1 mass ratio of fixing agent and sludge was conducted. Pozzolonic process is the cheapest of those evaluated. Cement costs $70 per ton whereas pozzolonic costs as low as $12.50 per ton depending on the type of fly ash used (bulk or bagged). Total disposal costs increase as the mass ratio of fixing agent to dry weight sludge increases. The authors provide a conceptual design of a process along with estimated costs to construct a one ton per day system. Total system capital/construction costs are estimated to be $65,000.

**CONTAMINANTS**:

Analytical data is provided in the treatability study report. The breakdown of the contaminants by treatability group is:

| Treatability Group | CAS Number | Contaminants |
|---|---|---|
| W10-Nonvolatile Metals | 7440-47-3 | Chromium |
| | 7440-02-0 | Nickel |
| W11-Volatile Metals | 7440-43-9 | Cadmium |
| W12-Other Inorganics | 57-12-5 | Cyanide |

**Leaching Studies of Raw and LFA Fixated (2:1) Cylinders**

| | Untreated EPA-RCRA | Treated EPA-RCRA | Untreated D.I. $H_2O$ | Treated D.I. $H_2O$ |
|---|---|---|---|---|
| Cr | 73.0* | 2.9 | 0.63 | <0.01 |
| Ni | 65.6 | 1.0 | 0.61 | 0.04 |
| Cu | 22.0 | 1.0 | 0.24 | 0.07 |

*All values in mg/l of leachate.

**NOTE: Quality assurance of data may not be appropriate for all uses.**

3/89-30 **Document Number: FAAP**

## SUPERFUND TREATABILITY CLEARINGHOUSE ABSTRACT

### Treatment Process: Immobilization - Stabilization

| | |
|---|---|
| ***Media:*** | Soil/Generic |
| ***Document Reference:*** | Lopat Enterprises, Inc. "Representative Selection of Laboratory Experiments and Reports of Full-Scale Commercial Use Which Demonstrate the Effectiveness of K-20 Lead-in Soil Control System in Physical/ Chemical Solidification, Fixation, Encapsulation & Stabilization of Certain Soil, Ash, Debris and Similar Wastes." Technical data report. Approximately 60 pp. Assembled for CDM. August 1987. |
| ***Document Type:*** | Contractor/Vendor Treatability Study |
| ***Contact:*** | Lou Parent<br>Lopat Enterprises, Inc.<br>1750 Bloomsbury Avenue<br>Wanamassa, NJ 07712<br>201-922-6600 |
| ***Site Name:*** | Confidential |
| ***Location of Test:*** | Lopat Enterprises, Inc., Wanamassa, NJ |

**BACKGROUND:** The report consists of brief summaries of seven bench-scale tests conducted by Lopat Enterprises for their clients. Lopat Enterprises report that their technique will stabilize solids contaminated with inorganic volatile and non-volatile metals (Cd, Zn, Hg,Pb, Cr, Ni, Cu), non-metallic toxic elements (As), and certain organics (PCBs).

**OPERATIONAL INFORMATION**: Lopat Enterprises uses a proprietary technology called K-20tm Lead-in-Soil Control System (K-20/LSC) for the physical/chemical fixation, solidification, encapsulation, and stabilization of contaminated soil and soil-like matrices. In the K-20/LSC system, two liquid components are blended and diluted prior to application to dry waste. Dry fixative materials are then added to the wetted waste material, and the dry waste are mixed with the K-20/LSC system components and allowed to cure for a day or more. The formulation of these components is site specific and proprietary. The volume of wastes treated varied with each project and was not reported.

**PERFORMANCE:** Lopat Enterprises reports that the K-20/LSC system is capable of reducing leachate concentrations by 90%. The document presents EP Toxicity test results before and after fixation of electric arc furnace dust, auto shredder residue, paint manufacturing sludge, blasting sand, incinerator bottom ash, blast furnace slag, and oil-soaked soil. Data are presented for Pb, Cd, Zn, As, Ba, and Cr. Initial concentrations of lead ranged from 9.8 ppm to 6200 ppm, although they are generally between 10 and 500 ppm. The initial concentrations and the percent reductions in metal concentrations in the leachate are summarized in the table on the next page. The percent reductions were highest for lead and lowest for chromium and barium. Costs reported were in the range of $15 to $20 per ton. QA/QC was not reported.

**CONTAMINANTS**:

Analytical data is provided in the treatability study report. The breakdown of the contaminants by treatability group is:

| Treatability Group | CAS Number | Contaminants |
|---|---|---|
| W10-Nonvolatile Metals | 7440-47-3 | Chromium |
| W11-Volatile Metals | 7439-92-1 | Lead |

Note: This is a partial listing of data. Refer to the document for more information.

**NOTE: Quality assurance of data may not be appropriate for all uses.**

**3/89-12** **Document Number: FCAK**

**Summary of Performance Data**

The following data is provided by Lopat Enterprises for their K-20/LSC stabilization treatment. The upper number is the concentration in the leachate prior to treatment, as determined by the EP Toxicity test. (Concentrations in the auto shredder residue were measured by the California Administrative Manual Waste Extraction Test.) The lower number is the percent reduction in leachate concentration following treatment.

| Waste | Pb | Cd | Zn | As | Ba | Cr |
|---|---|---|---|---|---|---|
| Electric arc furnace dust | 580 ppm<br>97-99% | 0.023 ppm<br>>80% | | | | |
| Auto shredder residue | 150-250 ppm<br>>80% | 2-6.7 ppm<br>>65->85% | 900-1600<br>>85% | | | |
| Incinerator bottom ash | 70.5 ppm<br>>99% | 0.048 ppm<br>67%->90% | | 0.17 ppm<br>59->94% | 35 ppm<br>>1-95% | 0.06 ppm<br>83% |
| Blasting sand | 6200 ppm<br>99% | | | | | |
| Paint manufacturing sludge | 9.8 ppm<br>63->95% | | | | | 1 ppm<br>7-44% |
| Blast furnace slag | 500 ppm<br>99% | | | | | |
| Oil soaked soil | 16.3 ppm<br>99% | | | | | |

**NOTE: Quality assurance of data may not be appropriate for all uses.**

## SUPERFUND TREATABILITY CLEARINGHOUSE ABSTRACT

### Treatment Process: Immobilization - Solidification

| | |
|---|---|
| ***Media:*** | Soil/Generic |
| ***Document Reference:*** | Acurex Corp. "BDAT for Solidification/Stabilization Technology for Superfund Soils (Draft Final Report)." Prepared for U.S. EPA. 75 pp. November 17, 1987. |
| ***Document Type:*** | EPA ORD Report |
| ***Contact:*** | Edwin Barth<br>U.S. EPA, ORD, HWERL<br>26 W. St. Clair Street<br>Cincinnati, OH 45268<br>513-569-7669 |
| ***Site Name:*** | BDAT SARM-Manufactured Waste (Non-NPL) |
| ***Location of Test:*** | Mountain View, CA 94039 |

**BACKGROUND:** This report evaluates the performance of solidification as a method for treating solids from Superfund sites. Tests were conducted on four different artificially contaminated soils which are representative of soils found at the sites. Contaminated soils were solidified using common solidification agents or binders. Samples were tested for unconfined compressibility at various times after solidification and certain samples were subjected to the toxic contaminants/leach procedure (TCLP) tests and total waste analysis. Volatile organics levels were also measured during solidification and long term set up of the soils.

**OPERATIONAL INFORMATION**: The testing was done on four different types of Synthetics Analytical References Mixtures (SARM) prepared under separate contract for the EPA. The SARMs varied in concentrations from high to low with respect to organics (2,000-20,000 ppm) and metals (1,000-50,000 ppm). Three different binding agents were used; Portland cement, lime kiln dust and lime/flyash (50/50 by wt). Mixtures were molded according to ASTM procedure 109-86 and the Unconfined Compressive Strength (UCS) was measured at 7,14,21, and 28 days after curing according to ASTM 104-86. Optimal percentage of water in the mixture was determined by cone penetrometer tests. Volatile organics (VOC) were analyzed after solidification of the samples using a Gas Chromatograph equipped with a flame ionization detector. Samples were tested on days 14 and 28 to determine whether VOC levels changed during curing. Total Waste Analysis and Toxic Contaminants Leach Procedure (TLCP) tests were conducted on samples having unconfined compressibility greater than 50 psi. This study contains a section on QA/QC procedures.

**PERFORMANCE:** Compressibility values increased with increasing cure time. The Portland cement samples had the greatest Unconfined Compressibility Test rating (UCS) followed by kiln dust SARM and then the lime flyash SARM samples. The lime flyash samples took up to two weeks to set-up. The amount of water in the samples is critical and has as much effect on the final sample properties as the amount of binder used. Analysis of volatile and semivolatile organics by GC/FID revealed that emissions dropped only slightly during the 14 to 28 day curing process. This observation is consistent with earlier work that revealed that VOC emissions occur mostly during the soil mixing period and are relatively constant during the curing process. The result of the TCLP tests revealed that in certain instances none of the heavy metals could be leached out, however other TCLP results showed heavy metal concentrations greater than those in the initial SARM soil samples. The report contained no analysis or comment on the results of the TCLP tests. The results appear too variable to draw any definite conclusions regarding the ability of solidification agents to immobilize heavy metals.

**CONTAMINANTS:**

| Treatability Group | CAS Number | Contaminants |
|---|---|---|
| W01-Halogenated Aromatic Compounds | 108-90-7 | Chlorobenzene |
| W03-Halogenated Phenols Cresols and Thiols | 87-86-5 | Pentachlorophenol |
| W04-Halogenated Aliphatic Compounds | 107-06-2<br>127-18-4 | 1,2-Dichloroethane<br>Tetrachloroethene |
| W07-Heterocyclics & Simple Aromatics | 100-41-4<br>100-42-5<br>1330-20-7 | Ethylbenzene<br>Styrene<br>Xylenes |
| W08-Polynuclear Aromatics | 120-12-7 | Anthracene |
| W09-Other Polar Organic Compounds | 117-81-7<br>67-64-1 | Bis(2-Ethylhexyl)phthalate<br>Acetone |
| W10-Non-Volatile metals | 7440-47-3<br>7440-50-8<br>7440-02-0 | Chromium<br>Copper<br>Nickel |
| W10-Non-Volatile metals | 7440-47-3<br>7440-50-8<br>7440-02-0 | Chromium<br>Copper<br>Nickel |
| W11-Volatile Metals | 7440-43-9<br>7439-92-1<br>7440-66-6<br>7440-38-2 | Cadmium<br>Lead<br>Zinc<br>Arsenic |

**NOTE: Quality assurance of data may not be appropriate for all uses.**

3/89-50 **Document Number: FHMF**