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ENVIRONMENTAL CONSERVATION
REGION 9

FEASIBILITY STUDY
FOR VOC AND METALS IMPACTED SOILS
PRESTOLITE PLANT
ARCADE, NEW YORK

12/95

December 12, 1995

Prepared for:

Prestolite Plant Site
Arcade, New York

Prepared by:

Hydro-Search, Inc.
350 Indiana Street, Suite 300
Golden, Colorado 80401

STATE OF NEW YORK
BRENDAN F. SHINE
No. 070187
LICENSED PROFESSIONAL ENGINEER

Brendan Shine, P.E.

PROJECT NO. 204262089

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1.0 INTRODUCTION

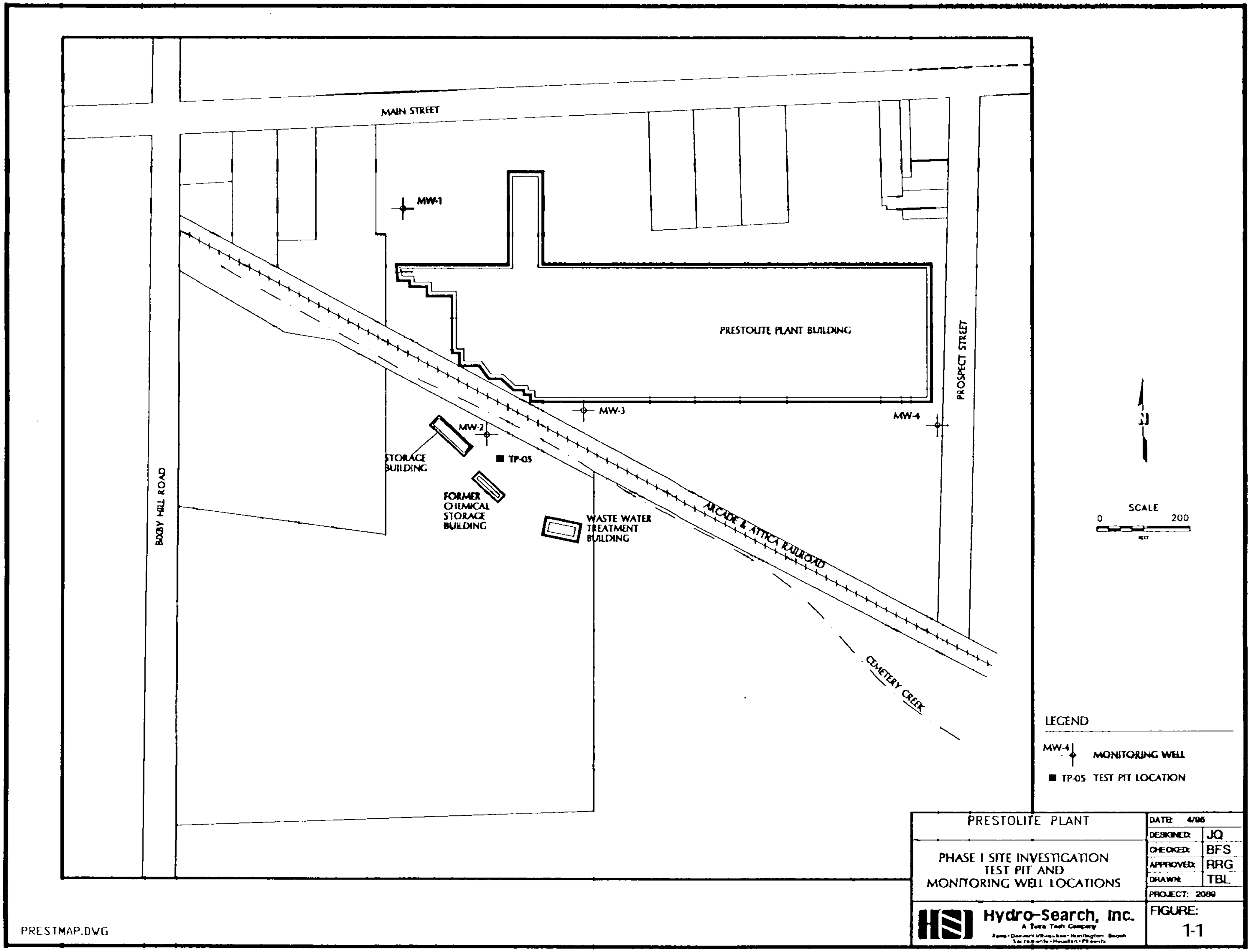
Remedial work is currently underway at the Prestolite Electric, Inc. (Prestolite) facility in Arcade, New York. This work focuses on source control to mitigate impacts to ground water and Cemetery Creek sediments. To date, remedial actions performed at the site include:

- The installation and operation of a soil vapor extraction system to remediate soils beneath the manufacturing building floor;
- Removal of contaminated sludge and water from a subsurface weir structure (followed by abandonment of the structure);
- Stabilization of metals impacted soils in the vicinity of the waste water treatment building; and
- The removal of metals impacted soils from the off-site runoff receiving area.

In addition, a work plan is being prepared to address metals impacts, if any, to Cemetery Creek sediments.

Volatile organic compound (VOC) concentrations in excess of anticipated levels were encountered in processed soils around the former chemical storage building (see Figure 1-1) during the metals impacted soil stabilization project. The heat generated during the stabilization reaction was not sufficient to drive-off the VOC constituents. Therefore, the VOC and metals impacted soils in the vicinity of the former chemical storage building have not yet been remediated. This feasibility study focuses on identifying and evaluating appropriate remedial alternatives for these soils. This document was prepared to fulfill requirements of Section IV paragraph (3) of the voluntary Order on Consent (Index #B9-0468-94-11) established between Prestolite, Motorola, Inc. (Motorola) and the New York State Department of Environmental Conservation (NYSDEC).

The remainder of Section 1.0 provides site background information conditions at the chemical storage area, and delineates the area and volume of affected soil. This information is critical


MAIN STREET
BUSBY HILL ROAD
PROSPECT STREET
PRESTOLITE PLANT BUILDING
MW-1
MW-2
MW-3
MW-4
TP-05
STORAGE BUILDING
FORMER CHEMICAL STORAGE BUILDING
WASTE WATER TREATMENT BUILDING
ARCADE & ATTICA RAILROAD
CEMETERY CREEK
N
SCALE
0
200
LEGEND
MW-4 MONITORING WELL
TP-05 TEST PIT LOCATION
PRESTOLITE PLANT
PHASE I SITE INVESTIGATION
TEST PIT AND
MONITORING WELL LOCATIONS
DATE: 4/96
DESIGNED: JQ
CHECKED: BFS
APPROVED: RRG
DRAWN: TBL
PROJECT: 2089
FIGURE: 1-1
Hydro-Search, Inc.
A Tetra Tech Company
PRESTMAP.DWG

in supporting the feasibility study evaluations. Section 2.0 discusses the applicable New York State (NYS) standards, criteria and guidance which may apply to remediation of the soils. Section 3.0 identifies several available technologies for remediating the soil. Section 4.0 compiles and screens remedial alternatives and Section 5.0 completes the detailed analysis of the alternatives.

1.1 SUMMARY OF AVAILABLE DATA AND INFORMATION

Previous investigations relevant to the characterization of conditions around the former chemical storage building area at the Prestolite site include a Phase I site investigation performed in 1991 by IT Corporation (IT), followed by a Phase II site investigation preformed by Hydro-Search, Inc. (HSI) in January of 1992. HSI performed additional site characterization work, which is summarized in a site cleanup report issued in July/August of 1992.

In July of 1994, HSI was contracted to perform a metals impacted soil stabilization action in the area around the waste water treatment building. Final grading and reclamation in this part of the site is currently being completed.

These reports and activities are described in the following subsections as they relate to characterization of VOC and metals impacted soils around the former chemical storage building. Specific reference citations can be found in Section 6.0 of this document.

1.1.1 Phase I Site Investigation

In June of 1991, IT Corporation was contracted to conduct a Phase I site investigation of the Prestolite facility (IT, 1991). During that investigation, stained soils and stressed vegetation were observed around the former chemical storage building. Subsequent sampling and characterization conducted by IT in July of 1991 included an exploratory test pit (TP-05) dug to the north of the building. Test pit soil samples were collected at the 5- to 6-foot depth interval from a layer of burned material containing metal and wood debris. The approximate trench location is shown on Figure 1-1.

Analysis for VOCs in the test pit soil sample showed detections of toluene and ethylbenzene at concentrations of 300 and 55 μg/kg, respectively. Semi-volatile organic compounds (SVOCs) detected include napthalene (1,400 μg/kg), 2-methylnapthalene (1,300 μg/kg) and dibenzofuran (350 μg/kg). The test pit soils were not analyzed for metals. There was no further characterization of unsaturated zone soils in this part of the site during the Phase I investigation..

To assess impacts to ground water in the area, IT installed monitoring well MW-2 (Figure 1-1) downgradient of the former chemical storage building area. The depth to ground water in this well was approximately 16 feet below the ground surface. Analysis of ground water from this well showed detections of acetone (56 μg/l) and 2-butanone (9 μg/l). No other ground water monitoring wells were installed near the former chemical storage building area during the Phase I investigation.

1.1.2 Phase II Site Investigation

HSI was contracted to conduct a Phase II investigation at the Prestolite Plant (HSI, 1992a). Field work was performed in January and February of 1992. The investigation around the former chemical storage building area included soil gas sampling and ground water monitoring well installation and sampling. The chemical storage building was removed in January 1994. Surface and subsurface soil samples also were collected to the west of the chemical storage building.

The soil gas survey around the former chemical storage building consisted of 30 sample locations which were analyzed for methylene chloride, trichloroethelene (TCE), toluene, ethylbenzene and total xylenes. These samples were collected from the 3 to 4 foot depth interval. None of the analytes were detected in reportable concentrations at distances greater than 40 feet from the building. Concentrations of methylene chloride ranged from non-detected to 2,800 μg/l, the

TCE concentration ranged from below reporting limits (5 μg/l) to 88 μg/l and the toluene concentration ranged from non-detected to 230 μg/l. Ethylbenzene ranged from non-detected to 140 μg/l, and total xylenes ranged from non-detected to 200 μg/l. Table 1-1 shows the concentration range for these compounds. Soil gas isoconcentration maps for each of the analytes are provided on Figures 1-2 through 1-5.

One surface soil sample (SS-02) was collected at the location of monitoring well MW-6. This sample was analyzed for target compound list (TCL) VOCs, SVOCs, cyanide and target analyte list (TAL) metals. No organic compounds were detected in this sample, but elevated concentrations of cadmium and chromium were detected (475 mg/kg and 23.7 mg/kg, respectively).

Subsurface soil samples were collected during the installation of ground water monitoring well MW-6D (Figure 1-6). All subsurface soil samples were screened using a photoionization detector (PID) equipped with an 11.7 eV bulb. No detections were noted from any samples collected from borings using the PID. Soil samples were composited from the 2 to 8 foot depth interval and a grab sample was collected from a depth of 5 feet. The samples were analyzed for TCL VOCs, SVOCs, cyanide and TAL metals. No organic compounds were detected and metal concentrations in the sample were all comparable to background levels.

Ground water samples were collected from wells MW-2, MW-6, and MW-6D, all located near the chemical storage building area. To facilitate metals impacted soil stabilization, these three wells have since been abandoned and replaced with similarly constructed wells (designated MW-2A, MW-6A and MW-6DA) near the original locations. MW-2 was downgradient (north) of the chemical storage building and was a water table well. MW-6 and MW-6D were located to the west of the former chemical storage building. MW-6 was a shallow (water table) well and MW-6D monitored water in the deeper water-bearing strata. Depth to water (from top of casing) in MW-2 and MW-6 during the Phase II investigation was 13.65 feet and 14.45 feet, respectively. These wells were approximately flush with ground surface. The potentiometric level in MW-6D was 12.10 feet, representing an upward vertical gradient of 0.83 ft/ft at this

TABLE 1-1
PHASE II SOIL GAS SURVEY RESULTS AROUND THE FORMER CHEMICAL STORAGE BUILDING
All values in $\mu g/l$ (parts per billion)

	Chemical Storage Building (GPO Sample Station)													
	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Methylene Chloride	BRL	BRL	28	320	530	ND	ND	2,800	64	ND	ND	ND	1,700	ND
Trichloro-ethylene	BRL	BRL	12	BRL	BRL	ND	BRL	88	17	9	BRL	BRL	BRL	BRL
Toluene	40	70	230	ND	ND	ND	BRL	190	65	50	37	ND	ND	ND
Ethyl-benzene	140	47	140	ND	ND	ND	62	60	49	44	ND	ND	ND	ND
Total Xylenes	150	150	79	ND	ND	ND	200	140	120	100	37	ND	ND	ND

	Chemical Storage Building (GPO Sample Station)													
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Methylene Chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloro-ethylene	BRL	BRL	BRL	BRL	BRL	ND	ND	BRL	BRL	ND	BRL	BRL	BRL	BRL	ND
Toluene	ND	ND	BRL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethyl-benzene	38	ND	BRL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Xylenes	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND Non-detected
BRL Below reporting limits

(12/12/95)

(2089/voc.rpt)

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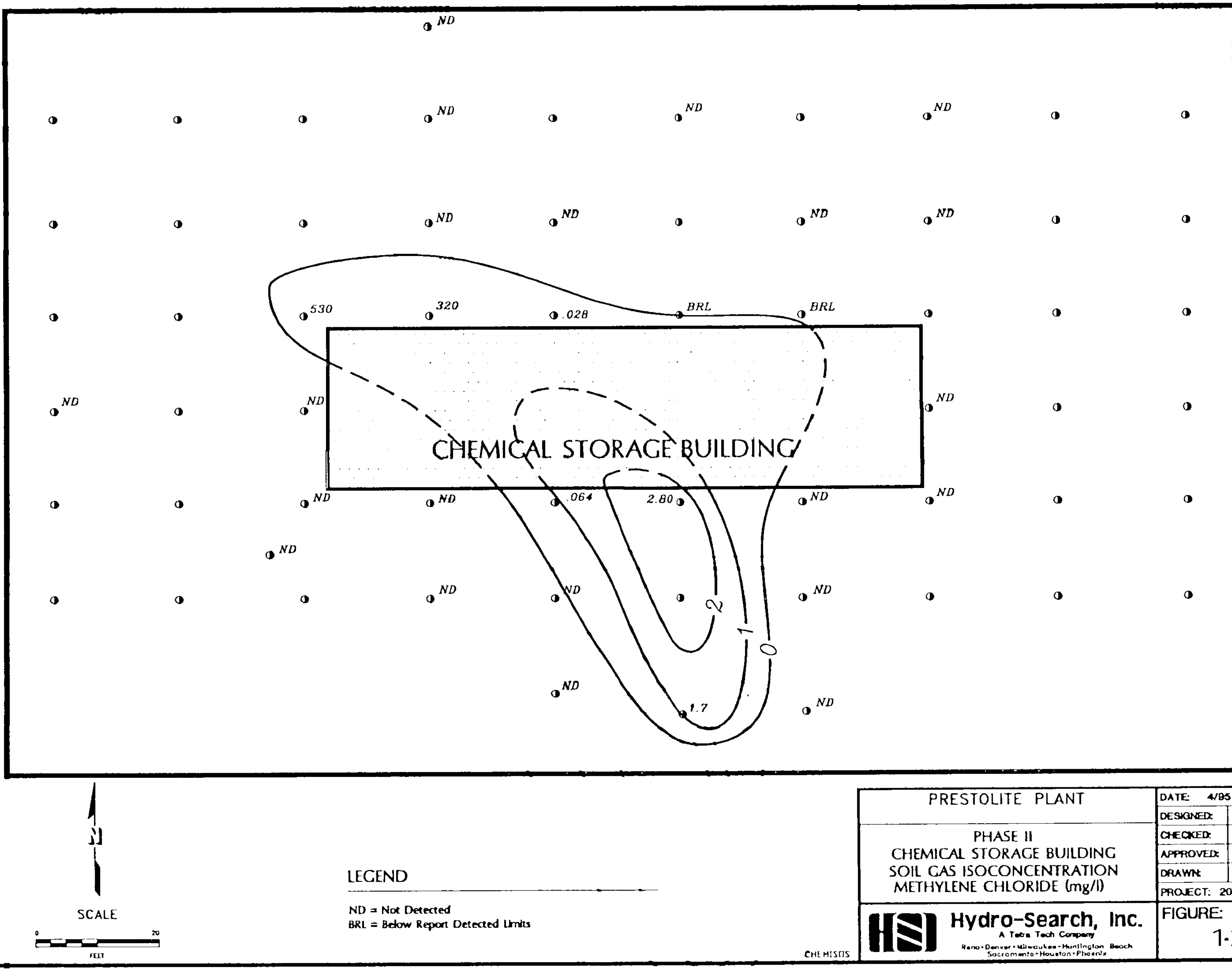


LEGEND

ND = Not Detected
BRL = Below Report Detected Limits

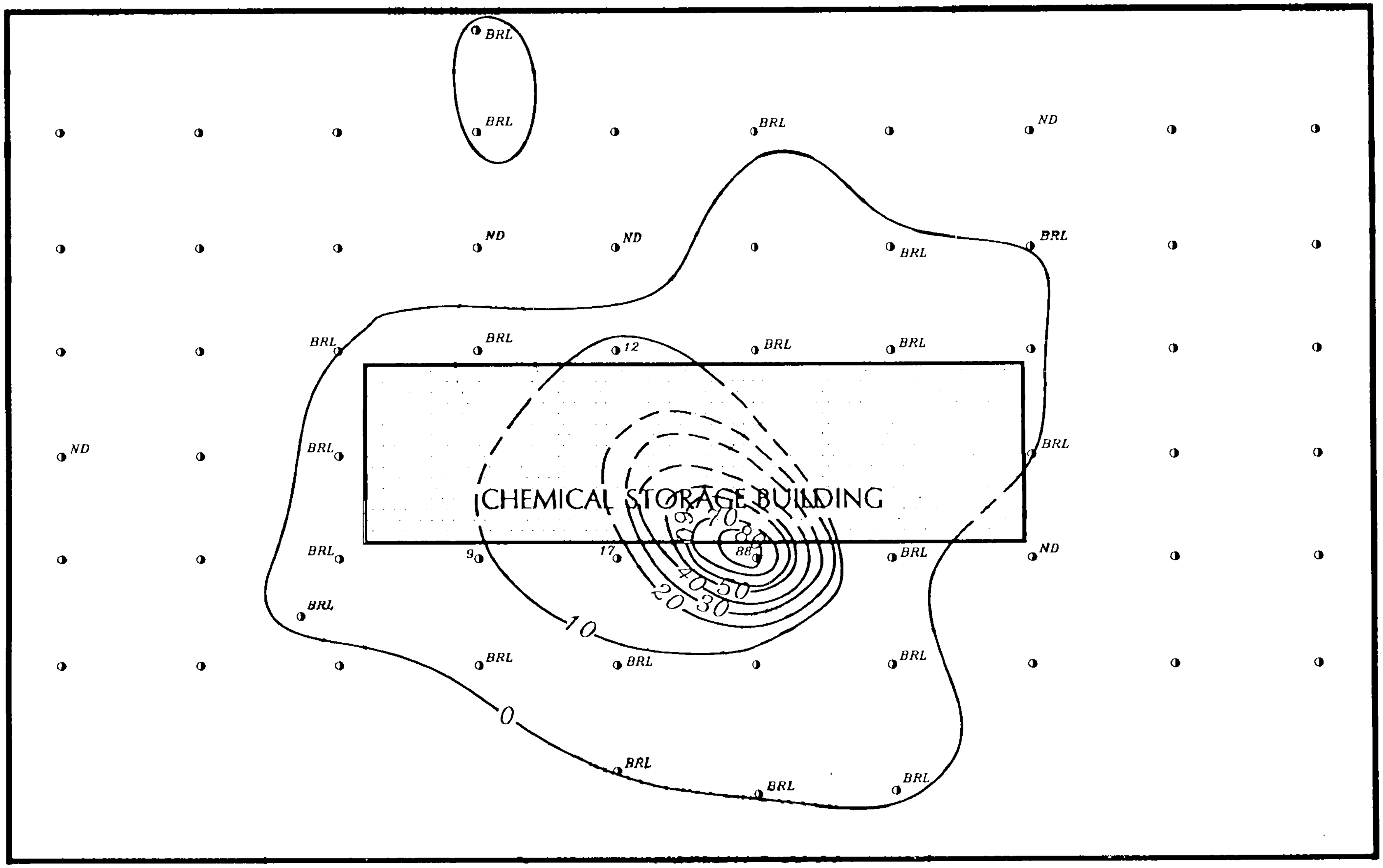
CHEMISOS

PRESTOLITE PLANT

PHASE II
CHEMICAL STORAGE BUILDING
SOIL GAS ISOCONCENTRATION
METHYLENE CHLORIDE (mg/l)

Hydro-Search, Inc.
A Tetra Tech Company
Reno • Denver • Milwaukee • Huntington Beach
Sacramento • Houston • Phoenix

DATE:	4/95
DESIGNED:	BS
CHECKED:	
APPROVED:	RG
DRAWN:	TBL
PROJECT:	2089
FIGURE:	1-2



8

N

SCALE

0 20

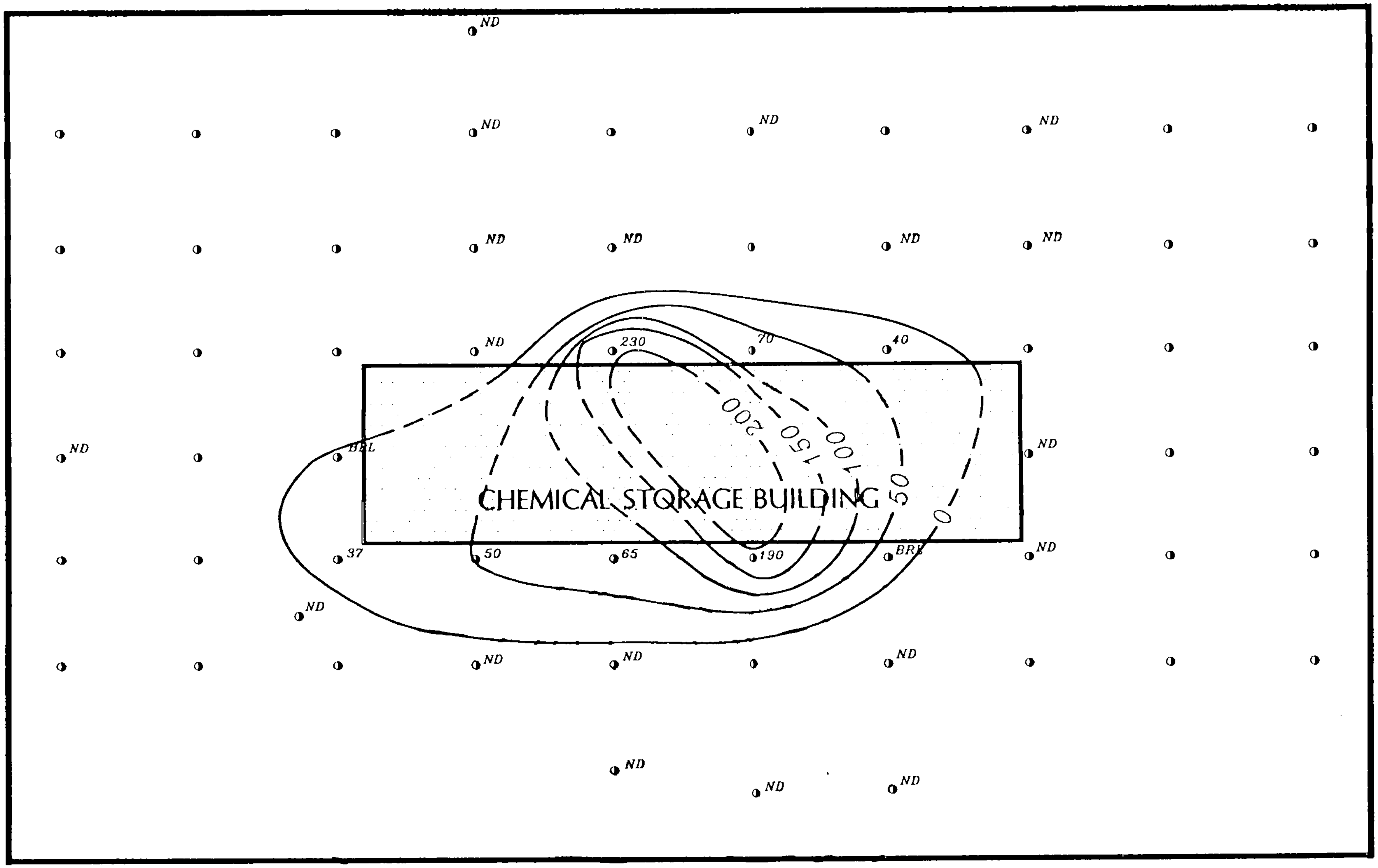
FEET

LEGEND

ND = Not Detected
BRL = Below Report Detected Limits

CHEMISDS

PRESTOLITE PLANT	DATE: 4/95
	DESIGNED: BS
PHASE II CHEMICAL STORAGE BUILDING SOIL GAS ISOCONCENTRATION TCE (ug/l)	CHECKED:
	APPROVED: RG
	DRAWN: TBL
	PROJECT: 2089
Hydro-Search, Inc. A Tetra Tech Company Reno • Denver • Milwaukee • Huntington Beach Sacramento • Houston • Phoenix	FIGURE: 1-3



SCALE

0 20

FEET

LEGEND

ND = Not Detected
BRL = Below Report Detected Limits

CHEMISOS

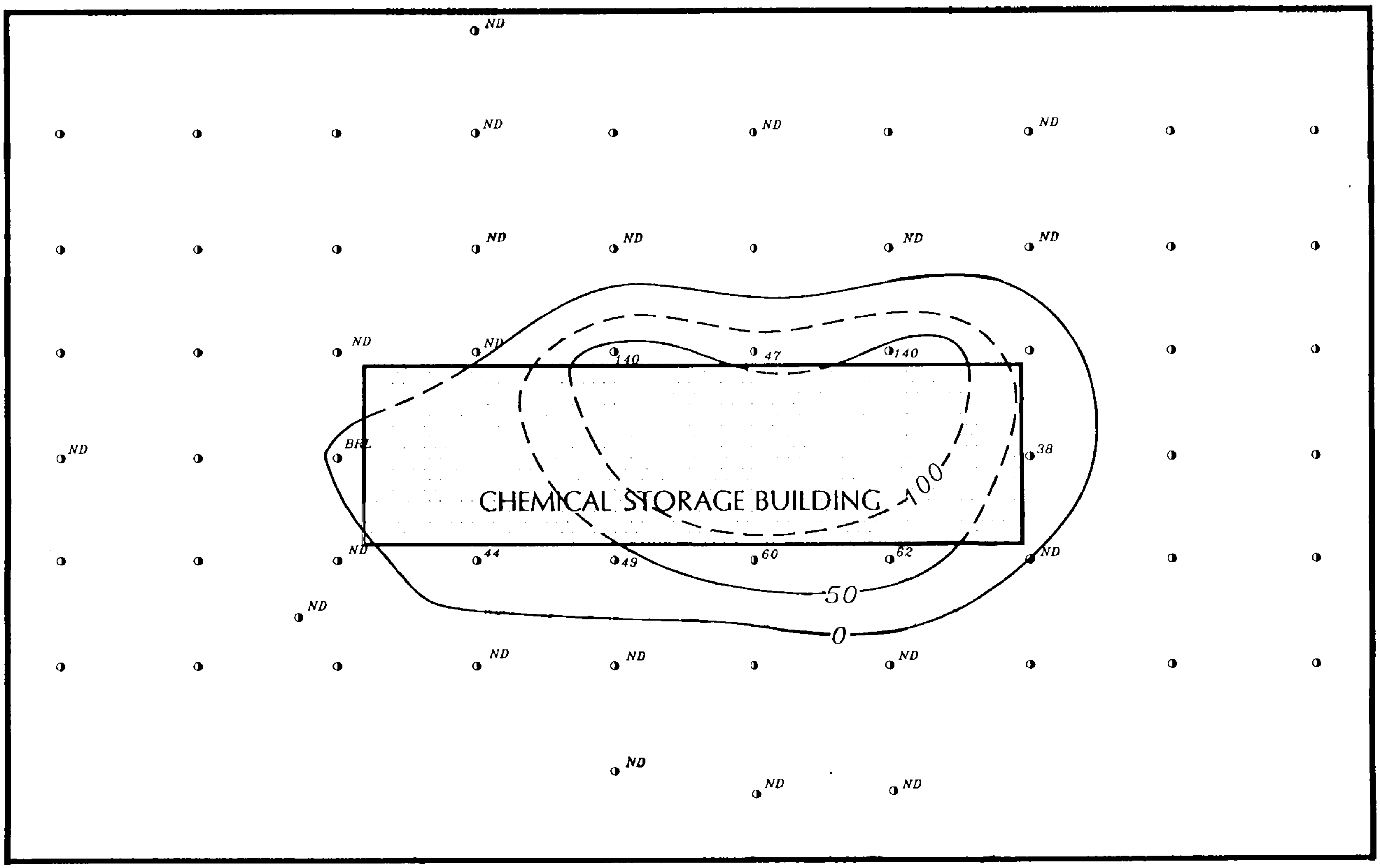
PRESTOLITE PLANT

PHASE II
CHEMICAL STORAGE BUILDING
SOIL GAS ISOCONCENTRATION
TOLUENE (ug/l)

Hydro-Search, Inc.
A Tetra Tech Company
Reno • Denver • Milwaukee • Huntington Beach
Sacramento • Houston • Phoenix

DATE:	4/95
DESIGNED:	BS
CHECKED:	
APPROVED:	RG
DRAWN:	TBL
PROJECT:	2089

FIGURE:
1-4



N

SCALE

0 20

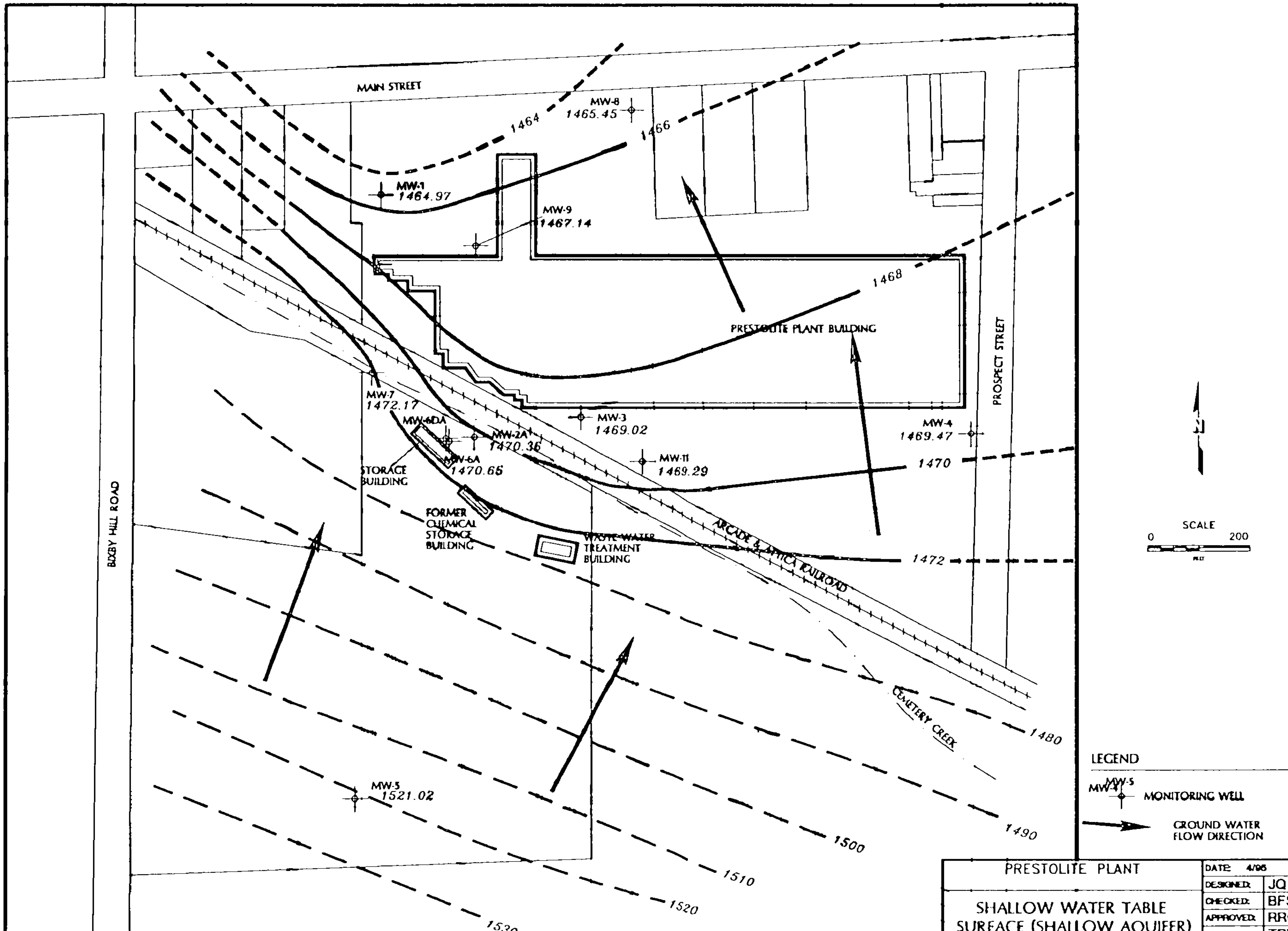
FEET

LEGEND

ND = Not Detected
BRL = Below Report Detected Limits

CHEMISOS

PRESTOLITE PLANT	DATE: 4/95
	DESIGNED: BS
CHEMICAL STORAGE BUILDING SOIL GAS ISOCONCENTRATION ETHYLBENZENE (ug/l)	CHECKED:
	APPROVED: RG
	DRAWN: TBL
	PROJECT: 2089
Hydro-Search, Inc. A Tetra Tech Company Reno • Denver • Milwaukee • Huntington Beach Sacramento • Houston • Phoenix	FIGURE: 1-5



PRESTOLITE PLANT	
SHALLOW WATER TABLE SURFACE (SHALLOW AQUIFER) APRIL 1995	DATE: 4/95
	DESIGNED: JQ
	CHECKED: BFS
	APPROVED: RRG
	DRAWN: TBL
	PROJECT: 2089
Hydro-Search, Inc. A Tetra Tech Company	FIGURE: 1-6

PRESTMAP.DWG

location. Well locations (including data from replacement wells WM-2A, MW-6A and MW-6DA), the water table surface, and the direction of shallow ground water flow, as measured in April 1995, are presented on Figure 1-6.

Ground water samples collected from MW-2 during Phase II sampling showed a TCE concentration of 17 μg/l. Methylene chloride was detected in samples from MW-6 and MW-6D, but similar concentrations were detected in the laboratory method blank. Acetone was also detected in MW-6 and in the laboratory method blank. Methylene chloride and acetone are both common laboratory-introduced contaminants. In accordance with U.S. EPA Functional Guidelines for Data Validation of Organic Analyses (1988), the concentration of contaminants detected in QC samples was multiplied by ten to determine a relative baseline. Reported methylene chloride and acetone concentrations both fell below the baseline in ground water samples from this part of the site. Therefore, the presence of these compounds in believed to be a laboratory artifact and not representative of actual site conditions. No other organic compounds were detected in samples collected from these wells during the Phase II investigation. Analytical results for all samples from these wells are summarized on Tables 1-2 and 1-3.

1.1.3 July/August 1992 Arcade Site Cleanup Report

Based on the findings and recommendations of the Phase II report, additional characterization activities were performed in the area around the waste water treatment and former chemical storage buildings (HSI, 1992b). These activities included a geomagnetic survey and surface soil sampling in the area immediately north and west of the waste water treatment building and north and east of the chemical storage building. Test trenches and soil samples also were collected in the chemical storage building area. Soil samples and trench locations are shown on Figure 1-7. Details and results of these characterization activities are provided in the HSI July/August, 1992 Arcade Site Cleanup Report.

The geophysical survey indicated elevated and erratic background levels. A total of 24 surface soil samples were collected from a grid on 20-foot centers as shown on Figure 1-7. The area

TABLE 1–2
SUMMARY OF VOLATILE ORGANIC COMPOUND CONCENTRATIONS IN GROUND WATER SAMPLES THROUGH JANUARY 1995
ARCADE, NEW YORK
(ug/l)

Well Number	MW–02A	MW–02					MW–05					
Date Sampled	1/95	5/94	11/93	6/93	10/92	2/92	1/95	5/94	11/93	6/93	10/92	2/92
Toluene	7 J	12	(0.7) BJ	100	ND	ND	ND	ND	NS	ND	ND	ND
Benzene	ND	ND	ND	3 J	ND	ND	ND	ND	NS	ND	ND	ND
Methylene Chloride	ND	ND	ND	ND	ND	4 J	ND	ND	NS	ND	ND	ND
Acetone	16	ND	ND	ND	ND	ND	ND	ND	NS	ND	(12)	10
Trichloroethylene	17	22	32 B	2 J	29	17	ND	ND	NS	ND	ND	ND
1,1,1–Trichloroethane	2 J	3 J	5	2 J	7 J	ND	ND	ND	NS	ND	ND	ND
1,2–Dichloroethene	24	83	ND	59	12	ND	ND	ND	NS	ND	ND	ND
1,1–Dichloroethane	ND	ND	ND	5	ND	ND	ND	ND	NS	ND	ND	ND
Vinyl Chloride	10	27	3 J	110	ND	ND	ND	ND	NS	ND	ND	ND
Ethylbenzene	41	28	ND	380	ND	ND	ND	ND	NS	ND	ND	ND
Total Xylenes	93	150	ND	1400	ND	ND	ND	ND	NS	ND	ND	ND
1,1,2–CL3–1,2,2–F3 Ethane	11 JN	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND
2–Hexanone	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND

B = The analyte is found in the lab blank as well as in the sample, indicating potential sample contamination and warning the data user to take appropriate action.

D = Deep well

J = Mass spectral data indicates the presence of a compound but the result is less than the specified detection limit, but still greater than 0.

N = Indicates presumptive evidence of a tentatively identified compound (TIC).

ND = The analyte was analyzed for but not detected

NS = Not sampled

(5) = Values in parentheses are less than 10 times that found in the field blank or laboratory method blanks and therefore are not representative of actual site conditions (i.e., attributable to artifacts or laboratory introduced contamination). Ref: U.S. EPA, 1988. Laboratory Data Validation Functional Guidelines for Evaluating Organics Analysis.

(2089/voc_org94)

TABLE 1-2 (cont)
SUMMARY OF VOLATILE ORGANIC COMPOUND CONCENTRATIONS IN GROUND WATER SAMPLES THROUGH JANUARY 1995
ARCADE, NEW YORK
(ug/l)

Well Number	MW-06A	MW-06					MW-06DA	MW-06D			
Date Sampled	1/95	5/94	11/93	6/93	10/92	2/92	1/95	11/93	6/93	10/92	2/92
Toluene	0.9 BJ	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND
Benzene	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND
Methylene Chloride	ND	ND	ND	ND	ND	3 J	ND	NS	ND	ND	4 J
Acetone	170	ND	ND	ND	ND	9 J	440 E	NS	ND	ND	ND
Trichloroethylene	59	3 J	(7) B	2 J	ND	ND	ND	NS	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND	44	ND	ND	NS	ND	ND	ND
1,2-Dichloroethene	2 J	11	ND	4 J	ND	ND	ND	NS	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND
Vinyl Chloride	ND	ND	1 J	ND	ND	ND	ND	NS	ND	ND	ND
Ethylbenzene	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND
Total Xylenes	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND
1,1,2-CL3-1,2,2-F3 Ethane	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND
2-Hexanone	2 J	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND

B = The analyte is found in the lab blank as well as in the sample, indicating potential sample contamination and warning the data user to take appropriate action.

D = Deep well

J = Mass spectral data indicates the presence of a compound but the result is less than the specified detection limit, but still greater than 0.

N = Indicates presumptive evidence of a tentatively identified compound (TIC).

ND = The analyte was analyzed for but not detected

NS = Not sampled

(5) = Values in parentheses are less than 10 times that found in the field blank or laboratory method blanks and therefore are not representative of actual site conditions (i.e., attributable to artifacts or laboratory introduced contamination). Ref: U.S. EPA, 1988. Laboratory Data Validation Functional Guidelines for Evaluating Organics Analysis.

(2089/voc_org94)

TABLE 1-3
SUMMARY OF TOTAL AND DISSOLVED INORGANICS DATA
IN GROUND WATER SAMPLES THROUGH JANUARY 1995
ARCADE, NEW YORK
(mg/l)

	MW-02A	MW-02				MW-02A	MW-02				MW-05				
PARAMETER	Total					Dissolved					Total				
DATE SAMPLED	1/95	5/94	11/93	6/93	10/92	1/95	5/94	11/93	6/93	10/92	1/95	5/94	11/93	6/93	10/92
Aluminum	NA	9.6	NA	240,000	130,000	NA	U	NA	140	U	NA	U	NS	121,000	269,000
Antimony	NA	U	NA	U	U	NA	U	NA	U	U	NA	U	NS	U	U
Arsenic	NA	0.02	NA	610	11.1	NA	0.0037	NA	24	2.6 B	NA	0.084	NS	170	36.4
Barium	NA	1.6	NA	3,900	2,960	NA	0.87	NA	900	738	NA	U	NS	850	2,680
Beryllium	NA	U	NA	9	7.6 B	NA	U	NA	U	U	NA	U	NS	U	12.4 B
Cadmium	7.9 *	U	0.017	U	U	U	U	U	U	U	U	0.011	NS	U	U
Calcium	NA	124	NA	575,000	402,000	NA	98.7	NA	85,400	76,600	NA	168	NS	275,000	775,000
Chromium	191	0.026	NA	300	170	U	U	NA	U	U	65.3 *	0.089	NS	190	450
Cobalt	NA	U	NA	180	111 B	NA	U	NA	U	U	NA	0.18	NS	99	249 B
Copper	NA	0.26	NA	2,900	1,070	NA	0.006	NA	U	U	NA	0.097	NS	360	623
Iron	NA	39	NA	530,000	365,000	NA	2.7	NA	10,100	1,290	NA	0.29	NS	339,000	629,000
Lead	295 E	0.22	NA	1,100	495	U	U	NA	U	U	50 *	0.078	NS	67	235
Magnesium	NA	43.8	NA	237,000	187,000	NA	10	NA	13,100	10,500	NA	32.4	NS	104,000	228,000
Manganese	NA	8.6	NA	9,300	27,900	NA	2.2	NA	1,400	1,380	NA	1.2	NS	4,500	15,000
Mercury	NA	0.0009	NA	1.2	0.57	NA	U	NA	U	U	NA	0.0004	NS	0.5	0.56
Nickel	NA	0.04	NA	550	304	NA	U	NA	U	U	NA	0.19	NS	230	598
Potassium	NA	3.1	NA	18,200	16,600	NA	1.9	NA	2,600	2,850 B	NA	270	NS	30,600	45,200
Selenium	NA	0.068	NA	U	U	NA	0.015	NA	U	U	NA	0.023	NS	U	U
Silver	NA	0.007	NA	24	U	NA	U	NA	U	U	NA	U	NS	8	U
Sodium	NA	5	NA	31,400	7,630 B	NA	10	NA	9,000	6,400	NA	32	NS	39,200	27,300
Thallium	NA	U	NA	U	2.8 B	NA	U	NA	U	U	NA	U	NS	U	U
Vanadium	NA	0.021	NA	330	288	NA	U	NA	U	U	NA	0.21	NS	150	488
Zinc	NA	0.41	NA	4,100	2,570	NA	0.023	NA	17	6.4 B	NA	0.069	NS	640	1,700

NA = Not Analyzed NS = Not Sampled Abd. = Abandoned

* = Inidcates duplicate analysis not within control limits.

S = Indicates value determined by Method of Standard Addition.

U = The analyte was analyzed for but not detected.

B = The reported value was obtained from a reading that was less than the Contract Required Detection Limit (CRDL) but greater than or equal to the Instrument Detection Limit (IDL).

E = Indicates a value estimated or not reported due to the presence of interference.

W = Post digestion spike for Furnace AA analysis out of control limits (85-115%), while sample absorbance is less than 50% of spike absorbance.

(2089\voc_inorg)

TABLE 1-3
SUMMARY OF TOTAL AND DISSOLVED INORGANICS DATA
IN GROUND WATER SAMPLES THROUGH JANUARY 1995
ARCADE, NEW YORK
(mg/l)

	MW-05					MW-06A	MW-06				MW-06A	MW-06			
PARAMETER	Dissolved					Total	Total				Dissolved				
DATE SAMPLED	1/95	5/94	11/93	6/93	10/92	1/95	5/94	11/93	6/93	10/92	1/95	5/94	11/93	6/93	10/92
Aluminum	NA	U	NS	180	U	NA	U	NA	3,500	3,840	NA	U	NA	U	U
Antimony	NA	U	NS	U	U	NA	U	NA	U	U	NA	U	NA	U	U
Arsenic	NA	U	NS	5	2.7 B	NA	0.0071	NA	18	13.9	NA	0.0041	NA	9.3	14.1
Barium	NA	U	NS	280	247	NA	0.16	NA	110	172 B	NA	0.12	NA	120	145 B
Beryllium	NA	U	NS	U	U	NA	U	NA	U	U	NA	U	NA	U	U
Cadmium	U	U	NS	U	U	5.1 *	U	U	U	U	U	U	U	U	U
Calcium	NA	182	NS	78,900	69,900	NA	55.9	NA	57,600	60,200	NA	76.7	NA	49,700	56,300
Chromium	U	U	NS	U	U	103 *	U	NA	18	7.2 B	U	U	NA	U	U
Cobalt	NA	U	NS	U	U	NA	U	NA	U	U	NA	U	NA	U	U
Copper	NA	U	NS	8	U	NA	U	NA	15	11.4 B	NA	U	NA	U	U
Iron	NA	U	NS	80	40.0 B	NA	0.44	NA	13,100	9,380	NA	0.08	NA	110	34.6 B
Lead	U	U	NS	U	U	240 *	U	NA	U	9.3	U	U	NA	U	U
Magnesium	NA	32.5	NS	25,800	22,900	NA	14.7	NA	16,400	16,400	NA	12.2	NA	12,800	14,600
Manganese	NA	0.53	NS	370	235	NA	0.28	NA	280	333	NA	0.25	NA	200	223
Mercury	NA	U	NS	U	U	NA	0.0007	NA	U	U	NA	U	NA	U	U
Nickel	NA	U	NS	U	U	NA	U	NA	U	U	NA	U	NA	U	U
Potassium	NA	287	NS	12,300	13,200	NA	1.3	NA	1,900	4,000 B	NA	0.88	NA	1,700	3,690 B
Selenium	NA	0.012	NS	U	U	NA	0.0093	NA	U	U	NA	0.014	NA	U	U
Silver	NA	U	NS	U	U	NA	U	NA	U	U	NA	U	NA	U	U
Sodium	NA	34	NS	26,000	24,200	NA	6	NA	6,000	6,460	NA	6	NA	5,000	6,220
Thallium	NA	U	NS	U	U	NA	U	NA	U	U	NA	U	NA	U	U
Vanadium	NA	U	NS	U	U	NA	U	NA	U	U	NA	U	NA	U	U
Zinc	NA	0.011	NS	12	3.6 B	NA	U	NA	25	33	NA	0.016	NA	U	5.6 B

NA = Not Analyzed NS = Not Sampled Abd. = Abandoned
* = Inidcates duplicate analysis not within control limits.
S = Indicates value determined by Method of Standard Addition.
U = The analyte was analyzed for but not detected.
B = The reported value was obtained from a reading that was less than the Contract Required Detection Limit (CRDL) but greater than or equal to the Instrument Detection Limit (IDL).
E = Indicates a value estimated or not reported due to the presence of interference.
W = Post digestion spike for Furnace AA analysis out of control limits (85-115%), while sample absorbance is less than 50% of spike absorbance.

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TABLE 1-3
SUMMARY OF TOTAL AND DISSOLVED INORGANICS DATA
IN GROUND WATER SAMPLES THROUGH JANUARY 1995
ARCADE, NEW YORK
(mg/l)

	MW-06DA	MW-06D				MW-06DA	MW-06D		
PARAMETER	Total	Total				Dissolved			
DATE SAMPLED	1/95	5/94	11/93	6/93	10/92	1/95	11/93	6/93	10/92
Aluminum	NA	Abd.	NS	5,300	137,000	NA	NS	340	33.0 B
Antimony	NA	Abd.	NS	U	U	NA	NS	U	U
Arsenic	NA	Abd.	NS	14	11.6	NA	NS	9.7	7.1 B
Barium	NA	Abd.	NS	130	847 B	NA	NS	110	96.7 B
Beryllium	NA	Abd.	NS	U	6.2 B	NA	NS	U	U
Cadmium	U	Abd.	NS	U	U	U	NS	U	U
Calcium	NA	Abd.	NS	49,800	503,000	NA	NS	41,300	444,000
Chromium	21	Abd.	NS	18	200	22	NS	U	U
Cobalt	NA	Abd.	NS	12	149 B	NA	NS	U	U
Copper	NA	Abd.	NS	24	404	NA	NS	U	U
Iron	NA	Abd.	NS	14,300	357,000	NA	NS	U	30.8 B
Lead	UW	Abd.	NS	12	130	NA	NS	U	U
Magnesium	NA	Abd.	NS	19,100	178,000	UW	NS	15,300	15,800
Manganese	NA	Abd.	NS	170	7,190	NA	NS	69	20.6
Mercury	NA	Abd.	NS	U	U	NA	NS	U	U
Nickel	NA	Abd.	NS	U	329	NA	NS	U	U
Potassium	NA	Abd.	NS	9,900	19,000 B	NA	NS	9,000	9,340
Selenium	NA	Abd.	NS	U	U	NA	NS	U	U
Silver	NA	Abd.	NS	U	U	NA	NS	U	U
Sodium	NA	Abd.	NS	22,200	21,600	NA	NS	18,000	19,400
Thallium	NA	Abd.	NS	U	U	NA	NS	U	U
Vanadium	NA	Abd.	NS	U	268	NA	NS	U	U
Zinc	NA	Abd.	NS	41	1,040	NA	NS	20	2.8 B

NA = Not Analyzed NS = Not Sampled Abd. = Abandoned
* = Inidcates duplicate analysis not within control limits.
S = Indicates value determined by Method of Standard Addition.
U = The analyte was analyzed for but not detected.
B = The reported value was obtained from a reading that was less than the Contract Required Detection Limit (CRDL) but greater than or equal to the Instrument Detection Limit (IDL).
E = Indicates a value estimated or not reported due to the presence of interference.
W = Post digestion spike for Furnace AA analysis out of control limits (85-115%), while sample absorbance is less than 50% of spike absorbance.

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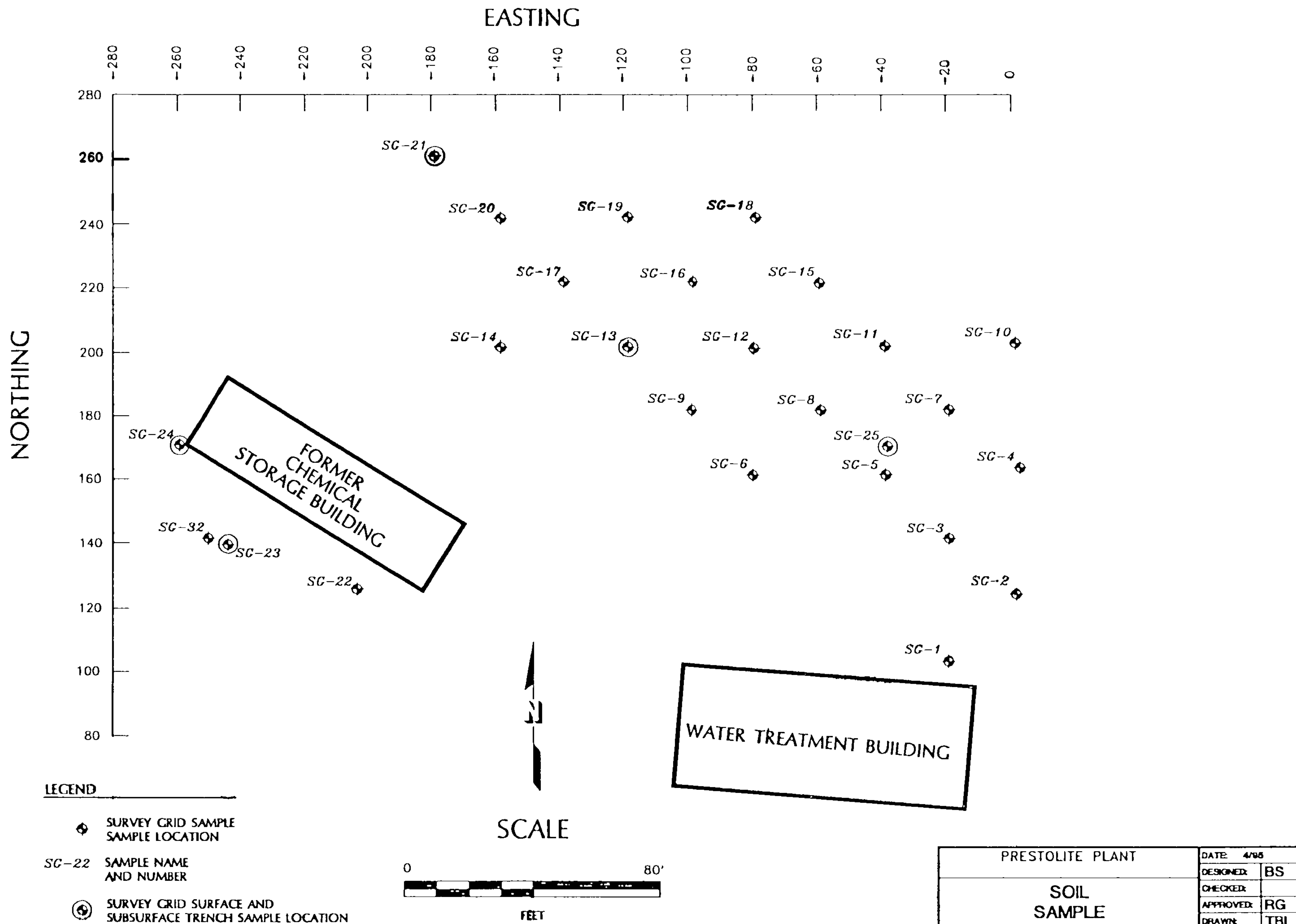

PRESTOLITE PLANT	DATE: 4/95
SOIL SAMPLE LOCATIONS	DESIGNED: BS
	CHECKED:
	APPROVED: RG
	DRAWN: TBL
	PROJECT: 2089
Hydro-Search, Inc. A Tetra Tech Company	FIGURE: 1-7

(soilsamp)

directly in front of the former chemical storage building were not sampled because it was covered by asphalt pavement. Samples were analyzed for cadmium, chromium and lead. Elevated concentrations of cadmium were detected in all but two of the samples (SG-7 and SG-14). Elevated concentrations of chromium were detected at locations SG-2 and SG-23. Cadmium concentrations ranged from 1.4 mg/kg to 1,260 mg/kg, chromium ranged from 2.8 mg/kg to 33.5 mg/kg and lead concentrations ranged from 8.6 mg/kg to 121 mg/kg. Tables 1-4 and 1-5 summarize sample locations and analytical results, respectively. Phase II surface soil and background concentrations are also presented for comparison.

To provide an indication of vertical concentration profiles, four test trenches were dug and soil samples were collected from depths of 2 and 4 feet. The soils were analyzed for cadmium, chromium and lead. Cadmium concentrations in subsurface samples ranged from 0.66 mg/kg to 590 mg/kg, chromium concentrations ranged from 10.5 mg/kg to 116 mg/kg and lead concentrations ranged from 12.9 mg/kg to 890 mg/kg. The trench located at surface sample location SG-21 showed no elevated metals, but the remaining trenches showed impacts down to a depth of at least 4 feet.

1.1.4 Ground Water Sampling

Ground water sampling events subsequent to the Phase I and II site characterizations have continued to show low-level concentrations of VOCs in MW-2 and MW-6. Tables 1-2 and 1-3 summarize organic and inorganic data, respectively. Analytical results for samples from upgradient well MW-5 are presented for comparison.

In January and February of 1995, wells MW-2A, MW-6A and MW-6DA were installed to replace MW-2, MW-6 and MW-6D, which were abandoned during soil stabilization operations. Sampling data from these wells are also included on Tables 1-2 and 1-3.

TABLE 1-4

ARCADE PRESTOLITE PLANT SITE SAMPLE LOCATIONS

Sample ID	Location Description			Date Collected
	Northing	Easting	Description	
Surface Soil Samples				
SS11			Former burning area	May 1992
SS12			Former burning area	May 1992
SS13			Former burning area	May 1992
SS14			Former burning area	May 1992
SS15			Former burning area	May 1992
SG-1	100	-20	Survey Grid	July 21, 1992
SG-2	120	0	Survey Grid	July 21, 1992
SG-3	140	-20	Survey Grid	July 21, 1992
SG-4	160	0	Survey Grid	July 21, 1992
SG-5	160	-40	Survey Grid	July 21, 1992
SG-6	160	-80	Survey Grid	July 21, 1992
SG-7	180	0	Survey Grid	July 21, 1992
SG-8	180	-60	Survey Grid	July 21, 1992
SG-9	180	-100	Survey Grid	July 21, 1992
SG-10	200	0	Survey Grid	July 21, 1992
SG-11	200	-40	Survey Grid	July 21, 1992
SG-12	200	-80	Survey Grid	July 21, 1992
SG-13	200	-120	Survey Grid	July 21, 1992
SG-14	200	-160	Survey Grid	July 21, 1992
SG-15	220	-60	Survey Grid	July 21, 1992
SG-16	220	-100	Survey Grid	July 21, 1992
SG-17	220	-140	Survey Grid	July 21, 1992
SG-18	240	-80	Survey Grid	July 21, 1992
SG-19	240	-120	Survey Grid	July 21, 1992
SG-20	240	-160	Survey Grid	July 21, 1992
SG-21	260	-180	Survey Grid	July 21, 1992
SG-22	124	-205	Survey Grid	July 22, 1992
SG-23	138	-245	Survey Grid	July 22, 1992
SG-24	170	-260	Survey Grid	July 22, 1992
Subsurface Soil Samples				
SG-25	170	-40	2-foot depth	July 22, 1992
SG-26	170	-40	4-foot depth; same location as SG-25	July 22, 1992
SG-27	260	-180	4-foot depth; same location as SG-21	July 22, 1992
SG-28	260	-180	2-foot depth; same location as SG-21	July 22, 1992
SG-30	200	-120	2-foot depth; same location as SG-13	July 22, 1992
SG-31	200	-120	4-foot depth; same location as SG-13	July 23, 1992
SG-32	140	-250	2-foot depth; same location as SG-23	July 23, 1992
SG-33	140	-250	4-foot depth; same location as SG-32	July 23, 1992

TABLE 1-5

INORGANIC CONCENTRATIONS IN SURFACE AND SUBSURFACE SOILS (mg/kg)

	SURFACE SOILS									
	RUNOFF RECEIVING AREA			FORMER BURNING AREA			CHEMICAL STORAGE BUILDING			
PARAMETER	SS03	SB08-1	SB08-2	SS02	SB09-1	SB02	SG-26	SG-27	SG-28	SG-30
Aluminum	12900	18500	15800	12900	9670	14700	--	--	--	--
Antimony	ND	ND	ND	ND	ND	ND	--	--	--	--
Arsenic	14.4	15.9	11.8	10.7	11.2	8.7	--	--	--	--
Barium	118	180	171	79.3	39.1 B	54.8	--	--	--	--
Beryllium	1.1 B	1.2 B	1.5	0.74 B	ND	0.86 B	--	--	--	--
Cadmium	8420	602	225	475	2.7	ND	15.8	0.66	0.43	590
Calcium	3230	2190	1690	12800	1670	1770	--	--	--	--
Chromium	44.3	22.2	19.1	23.7	12.9	17	116	10.5	13.2	18.8
Cobalt	12.8	14.9	16.2	11.1 B	7 B	10.6	--	--	--	--
Copper	224	32.7	17.4	75.4	25.8	21.3	--	--	--	--
Iron	24100	34800	34800	25700	21600	26400	--	--	--	--
Lead	241	21.9	24.4	22.9	14.5	16.7	267	37.7	12.9	890
Magnesium	2900	4280	3770	4880	3100	3820	--	--	--	--
Manganese	1160	1190	1800	740	1190	746	--	--	--	--
Mercury	ND	ND	ND	ND	ND	ND	--	--	--	--
Nickel	46.8	31.1	28.2	25.9	20.1	23.5	--	--	--	--
Potassium	1440	1590	1330	1450	986 B	1630	--	--	--	--
Selenium	ND	ND	ND	ND	ND	ND	--	--	--	--
Silver	0.75 B	0.87 B	1 B	ND	ND	0.56 B	--	--	--	--
Sodium	75.98	44.7 B	45.1 B	78.3 B	46.5 B	79.4 B	--	--	--	--
Thallium	ND	ND	ND	ND	ND	ND	--	--	--	--
Vanadium	16	23.2	22.1	16.5	11.9	18.1	--	--	--	--
Zinc	377	123	99.6	310	82.7	85.9	--	--	--	--

-- = Parameter not analyzed.

B = The analyte was found in the blank as well as in the sample indicating possible/probable contamination and warning the data user to take appropriate action.

ND = The analyte was analyzed for but not deteted.

NOTE: SS01, SS02, SS03, SB01 and SB02 were collected as part fo the Phase II Site Investigation and are shown for comparison only.
SG-25 and SG-26 were sampled at 2 and 4 feet, respectively.
SG-27 and SG-28 were sampled at location SG-21 at 4 and 2 feet, respectively.
SG-30 and SG-31 were sampled at location SG-13 at 2 and 4 feet, respectively.
SG-32 and SG-33 were sampled at location SG-23 at 2 and 4 feet, respectively.

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TABLE 1-5 (continued)

INORGANIC CONCENTRATIONS IN SURFACE AND SUBSURFACE SOILS (mg/kg)

	SURFACE SOILS (cont)											
	CHEMICAL STORAGE BUILDING			SURVEY GRID AREA								
PARAMETER	SG-31	SG-32	SG-33	SG-1	SG-2	SG-3	SG-4	SG-5	SG-6	SG-7	SG-8	SG-9
Aluminum	--	--	--	--	--	--	--	--	--	--	--	--
Antimony	--	--	--	--	--	--	--	--	--	--	--	--
Arsenic	--	--	--	--	--	--	--	--	--	--	--	--
Barium	--	--	--	--	--	--	--	--	--	--	--	--
Beryllium	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	35	98.5	588	35.8	401	113	764	519	510	6.4	292	34.5
Calcium	--	--	--	--	--	--	--	--	--	--	--	--
Chromium	15.4	17.2	16.4	5.8	33.5	12.4	14.1	13.3	17.4	8.2	12.5	6.3
Cobalt	--	--	--	--	--	--	--	--	--	--	--	--
Copper	--	--	--	--	--	--	--	--	--	--	--	--
Iron	--	--	--	--	--	--	--	--	--	--	--	--
Lead	75.2	26.7	77.2	12.6	99.3	37.1	44.2	121	90.8	11.6	25.2	12.4
Magnesium	--	--	--	--	--	--	--	--	--	--	--	--
Manganese	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	--	--	--	--	--	--	--	--	--	--	--	--
Nickel	--	--	--	--	--	--	--	--	--	--	--	--
Potassium	--	--	--	--	--	--	--	--	--	--	--	--
Selenium	--	--	--	--	--	--	--	--	--	--	--	--
Silver	--	--	--	--	--	--	--	--	--	--	--	--
Sodium	--	--	--	--	--	--	--	--	--	--	--	--
Thallium	--	--	--	--	--	--	--	--	--	--	--	--
Vanadium	--	--	--	--	--	--	--	--	--	--	--	--
Zinc	--	--	--	--	--	--	--	--	--	--	--	--

-- = Parameter not analyzed.

B = The analyte was found in the blank as well as in the sample indicating possible/probable contamination and warning the data user to take appropriate action.

ND = The analyte was analyzed for but not deteted.

NOTES: SS01, SS02, SS03, SB01 and SB02 were collected as part fo the Phase II Site Investigation and are shown for comparison only.
SG-25 and SG-26 were sampled at 2 and 4 feet, respectively.
SG-27 and SG-28 were sampled at location SG-21 at 4 and 2 feet, respectively.
SG-30 and SG-31 were sampled at location SG-13 at 2 and 4 feet, respectively.
SG-32 and SG-33 were sampled at location SG-23 at 2 and 4 feet, respectively.

(2089\voc3)

TABLE 1–5 (continued)
INORGANIC CONCENTRATIONS IN SURFACE AND SUBSURFACE SOILS (mg/kg)

	SURFACE SOILS (cont)											
	SURVEY GRID AREA (cont)											
PARAMETER	SG–10	SG–11	SG–12	SG–13	SG–14	SG–15	SG–16	SG–17	SG–18	SG–19	SG–20	SG–21
Aluminum	––	––	––	––	––	––	––	––	––	––	––	––
Antimony	––	––	––	––	––	––	––	––	––	––	––	––
Arsenic	––	––	––	––	––	––	––	––	––	––	––	––
Barium	––	––	––	––	––	––	––	––	––	––	––	––
Beryllium	––	––	––	––	––	––	––	––	––	––	––	––
Cadmium	701	512	182	229	3.9	146	260	70.7	215	406	118	105
Calcium	––	––	––	––	––	––	––	––	––	––	––	––
Chromium	13.4	14.4	12	7.7	6.1	17	13.9	2.8	14.6	10.7	13.8	11.3
Cobalt	––	––	––	––	––	––	––	––	––	––	––	––
Copper	––	––	––	––	––	––	––	––	––	––	––	––
Iron	––	––	––	––	––	––	––	––	––	––	––	––
Lead	33.6	51.5	33.3	22.5	9.5	34.3	74.9	8.6	41.9	35.7	44.6	26.9
Magnesium	––	––	––	––	––	––	––	––	––	––	––	––
Manganese	––	––	––	––	––	––	––	––	––	––	––	––
Mercury	––	––	––	––	––	––	––	––	––	––	––	––
Nickel	––	––	––	––	––	––	––	––	––	––	––	––
Potassium	––	––	––	––	––	––	––	––	––	––	––	––
Selenium	––	––	––	––	––	––	––	––	––	––	––	––
Silver	––	––	––	––	––	––	––	––	––	––	––	––
Sodium	––	––	––	––	––	––	––	––	––	––	––	––
Thallium	––	––	––	––	––	––	––	––	––	––	––	––
Vanadium	––	––	––	––	––	––	––	––	––	––	––	––
Zinc	––	––	––	––	––	––	––	––	––	––	––	––

–– = Parameter not analyzed.
B = The analyte was found in the blank as well as in the sample indicating possible/probable contamination and warning the data user to take appropriate action.
ND = The analyte was analyzed for but not deteted.
NOTES: SS01, SS02, SS03, SB01 and SB02 were collected as part fo the Phase II Site Investigation and are shown for comparison only.
SG–25 and SG–26 were sampled at 2 and 4 feet, respectively.
SG–27 and SG–28 were sampled at location SG–21 at 4 and 2 feet, respectively.
SG–30 and SG–31 were sampled at location SG–13 at 2 and 4 feet, respectively.
SG–32 and SG–33 were sampled at location SG–23 at 2 and 4 feet, respectively.

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TABLE 1–5 (continued)
INORGANIC CONCENTRATIONS IN SURFACE AND SUBSURFACE SOILS (mg/kg)

	SURFACE SOILS (cont)									BACKGROUND SAMPLES	
	SURVEY GRID AREA (cont)				FORMER BURNING AREA						
PARAMETER	SG–22	SG–23	SG–24	SG–25	SS11	SS12	SS13	SS14	SS15	SS01	SB01
Aluminum	--	--	--	--	11000	8290	8130	10600	12000	15600	12800
Antimony	--	--	--	--	ND	ND	ND	ND	ND	ND	ND
Arsenic	--	--	--	--	8.7	9.4	123	11	10.2	6.6	12.9
Barium	--	--	--	--	90.7	57.3	59.4	61.6	114	73	70.9
Beryllium	--	--	--	--	ND	ND	ND	ND	ND	0.76 B	0.68 B
Cadmium	1260	893	326	1.4	25.4	193	33.7	803	1230	ND	ND
Calcium	--	--	--	--	15800	10100	11100	2710	3370	1430	2400
Chromium	17.2	19.1	15.6	15.8	19.5	16.9	17.2	26.6	16.1	18	16
Cobalt	--	--	--	--	9.2 B	7.6 B	7.6 B	10 B	11.4 B	7 B	13
Copper	--	--	--	--	207	91.8	53.8	70.1	130	12.6	26.2
Iron	--	--	--	--	25900	19100	19700	23200	27300	22700	28300
Lead	45	50.9	36.7	33	54.4	32.2	36.7	107	51.5	18.1	16.2
Magnesium	--	--	--	--	4790	5170	5120	3290	3530	2440	9000
Manganese	--	--	--	--	722	604	660	495	947	406	408
Mercury	--	--	--	--	0.14	0.19	ND	0.14	ND	ND	ND
Nickel	--	--	--	--	27.8	20.9	21.8	23.8	22.8	11.3	26.3
Potassium	--	--	--	--	989 B	734 B	715 B	853 B	1070 B	1790	2130
Selenium	--	--	--	--	ND	0.27 B	ND	0.5 B	ND	ND	ND
Silver	--	--	--	--	ND	ND	ND	ND	ND	ND	0.71 B
Sodium	--	--	--	--	55.6 B	39.2 B	46.3 B	37.8 B	46.6 B	64.1 B	114 B
Thallium	--	--	--	--	ND	ND	ND	ND	ND	ND	ND
Vanadium	--	--	--	--	18.3	13.5	13 B	15.6	20	28.3	17.4
Zinc	--	--	--	--	236	208	214	436	636	79.7	73.9

-- = Parameter not analyzed.
B = The analyte was found in the blank as well as in the sample indicating possible/probable contamination and warning the data user to take appropriate action.
ND = The analyte was analyzed for but not deteted.
NOTES: SS01, SS02, SS03, SB01 and SB02 were collected as part fo the Phase II Site Investigation and are shown for comparison only.
SG–25 and SG–26 were sampled at 2 and 4 feet, respectively.
SG–27 and SG–28 were sampled at location SG–21 at 4 and 2 feet, respectively.
SG–30 and SG–31 were sampled at location SG–13 at 2 and 4 feet, respectively.
SG–32 and SG–33 were sampled at location SG–23 at 2 and 4 feet, respectively.

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1.1.5 Metals Impacted Soil Stabilization

A voluntary program was conducted to stabilize metals impacted soils around the waste water treatment plant. A document describing this remedial measure will be forthcoming upon the completion of the stabilization project. At this time, completion is anticipated in Spring of 1995.

During the excavation process, soils were screened with a PID to detect VOC contamination. As a result, a distinct boundary between soils impacted by both VOCs and metals and soils impacted by metals only was evident. The excavation did not proceed past this boundary, which defines the northern and eastern limits of the area presented on Figure 1-8.

While preparing an area for the soils stabilization equipment, the footings for the chemical storage building were removed. At some locations around the building perimeter, stained soils and strong odors were evident in soils around the footing at depths of up to four feet. Samples of these soils were collected and analyzed for total and TCLP TCL VOCs, cadmium, chromium and lead. Analytical results for these soils are summarized in Table 1-6 (Sample V2-175N,80E and V3-175N,80E for total and TCLP analyses, respectively) and the laboratory report is presented in Appendix A.

Ten cubic yards of metal and VOC impacted soil were treated to determine the effect of the metal stabilization process on VOC concentrations. The soil was selected using a PID screen from around the former chemical storage building footing on the basis of staining and strong organic odor. The soils were treated to stabilize metals using a 20% Portland cement mixture. After approximately 48 hours, the treated soil was analyzed for TCL VOCs (Sample BV-1A). To test for time dependant VOC attenuation, a second sample (GS-01) was collected two weeks later.

Analytical results from these samples are summarized in Table 1-7 and the laboratory reports are presented in Appendix B. RCRA Universal Treatment Standards (UTS), which apply landfilling requirements, are presented for comparison. The variation between samples is

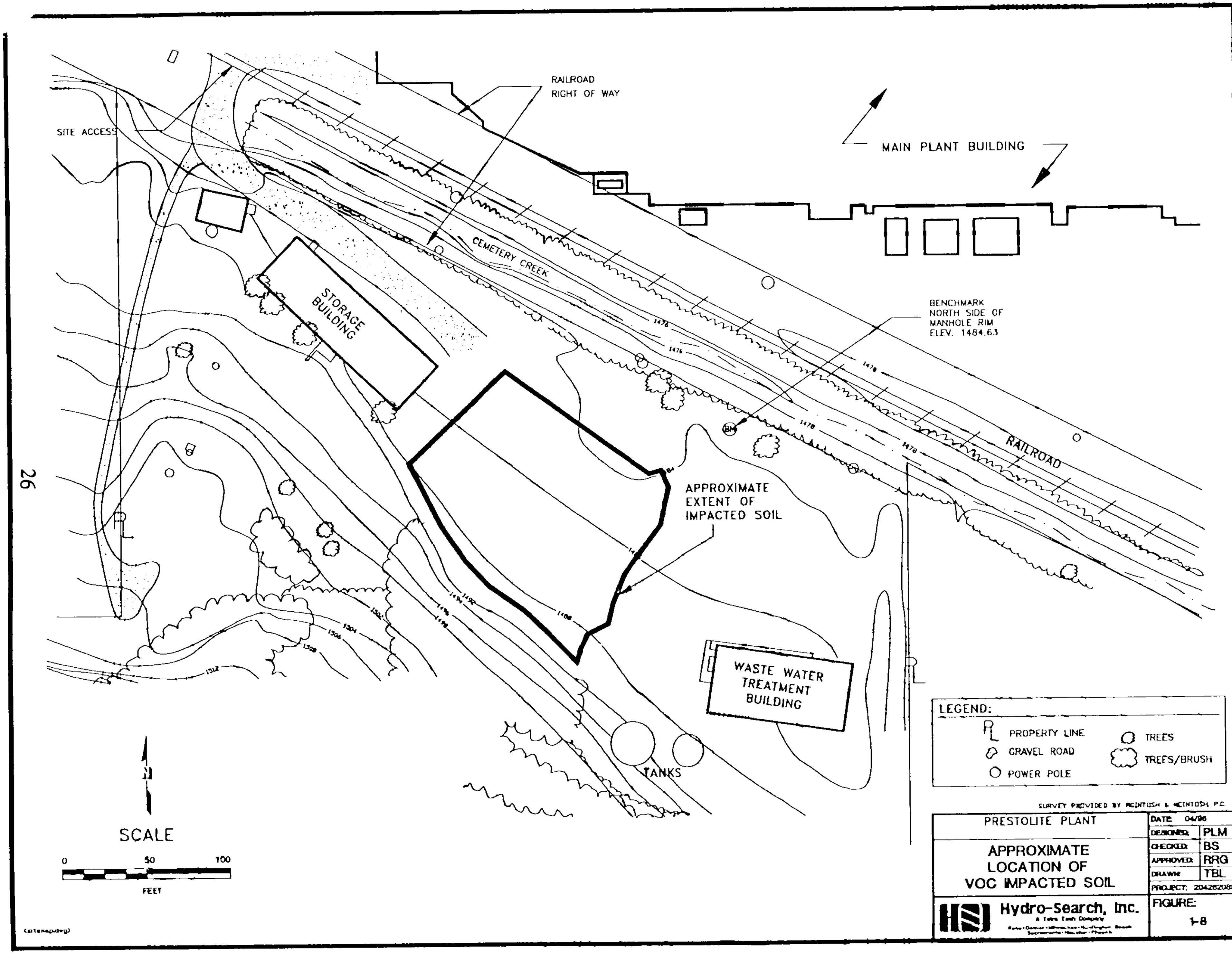
RAILROAD RIGHT OF WAY
MAIN PLANT BUILDING
SITE ACCESS
STORAGE BUILDING
CEMETERY CREEK
BENCHMARK NORTH SIDE OF MANHOLE RIM ELEV. 1484.63
RAILROAD
APPROXIMATE EXTENT OF IMPACTED SOIL
WASTE WATER TREATMENT BUILDING
TANKS
LEGEND:
PROPERTY LINE
GRAVEL ROAD
POWER POLE
TREES
TREES/BRUSH
SCALE
0
50
100
FEET
N
SURVEY PROVIDED BY MCINTOSH & MCINTOSH P.C.
PRESTOLITE PLANT
APPROXIMATE LOCATION OF VOC IMPACTED SOIL
DATE: 04/96
DESIGNED: PLM
CHECKED: BS
APPROVED: RRG
DRAWN: TBL
PROJECT: 204262089
FIGURE: 1-8
Hydro-Search, Inc.
A Tetra Tech Company
(sitemap.dwg)

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TABLE 1-6

SUMMARY OF INORGANIC AND VOC DETECTIONS IN SOILS FROM THE CHEMICAL STORAGE BUILDING FOOTING

Sample Type Sample ID	Total V2-175N,80E	TCLP 3-175N,80E
VOCS	(Concentrations in ug/kg)	(Concentrations in ug/l)
1,2-Dichloroethene (total)	19	U
Ethylbenzene	570 D	U
Tetrachloroethene	6	U
Toluene	47 B	U
Total Xylenes	2700 D	U
Trichloroethene	2 BJ	U
METALS	(Concentrations in ug/kg)	(Concentrations in ug/l)
Cadmium	98.8	2.26
Chromium	160	0.010
Lead	109	0.72

Notes:
1. "U" indicates that the analyte was not detected.
2. "B" indicates that the analyte was detected in the blank.
3. "D" indicates sample dilution to meet instrument calibration parameters.
4. "J" indicates that the analyte was detected at concentrations below reportable limits.
5. "NA" means that the sample was not analyzed for that analyte.

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TABLE 1-7

SUMMARY OF VOC DETECTIONS IN STABILIZED SOILS IN THE CHEMICAL STORAGE BUILDING AREA

SAMLE ID	*BV-1A* (ug/kg)	*GS-01* (ug/kg)	RCRA UTS (ug/kg)
Benzene	U	7,900	10
Ethylbenzene	6,300	18,000	10
Toluene	4,000	6,800	10
Total Xylenes	20,000	204,000	30
Trichloroethene	26	5,600	6.0
1,3,5-Trimethylbenzene	460	U	NS
Naphthalene	630	U	5.6
1,2,4-Trimethylbenzene	1,000	U	NS
n-Propylbenzene	790	U	NS
Isopropylbenzene	1,200	U	0
Chlorobenzene	18,000	U	6.0

Notes:

1. Both samples were collected from the same 10-cubic yard batch; GS 01 was collected two weeks after BV-1A.
2. Both samples were processed to stabilize Cd, Cr and Pb.
3. "U" indicates that the analyte was not detected.

NS = No standard

(2089\voctc2)

attributed to the heterogeneous character of the source material. Some of the highest contaminant concentrations from the two samples of treated soils were TCE (5.6 mg/kg), benzene (7.9 mg/kg), toluene (6.8 mg/kg), ethylbenzene (18 mg/kg), and xylenes (204 mg/kg).

1.2 Definition of Cleanup Volume and Depth

To better define the most appropriate remedial technology for the VOC and metals impacted soils, an estimate of impacted soil volume is required. Data generated during previous characterization and remediation work at the site (Section 1.1) and the assumptions listed in this section were used to estimate the volume of impacted soils.

1.2.1 Assumptions

Assumptions used in soils volume estimation are:

- Areas devoid of VOC contamination are excluded;
- VOC detections in monitoring well MW-2 are a result of ground water transport. Subsurface soil samples collected by IT during installation of MW-2 supports this assumption by showing only trace levels of VOCs with xylene being non-detected yet being the primary VOC detected in ground water at this location (IT, 1991);
- The southern extent of contamination is limited by the hill slope to the south of the former chemical storage building;
- Terrain has been accounted for by digitizing a topographic base map of the site compiled by McIntosh & McIntosh, which is a New York licensed surveying firm; and
- Impacts in the defined area extended to the shallow ground water surface, which was defined using water levels measured in April 1995. These water levels and elevations are presented in Table 1-8. Well locations and the water table surface are presented in Figure 1-6.

TABLE 1-8

WATER LEVEL DATA, PRESTOLITE PLANT, APRIL 1995

Well ID	Ground Elevation (MSL)	TOC Elevation (MSL)	Water Level (TOC, AMSL)	Water Elevation (TOC, AMSL)
MW-1	1473.69	1473.31	8.34	1464.97
MW-2A	1484.30	1483.84	13.52	1470.32
MW-3	1476.63	1476.23	7.21	1469.02
MW-4	1482.54	1482.29	12.82	1469.47
MW-5	1563.40	1566.40	45.38	1521.02
MW-6A	1484.92	1484.51	13.86	1470.65
MW-7	1481.09	1480.78	8.61	1472.17
MW-8	1474.35	1473.99	5.54	1465.45
MW-9	1475.74	1475.37	8.24	1467.13
MW-11	1477.62	1477.29	8.01	1469.28

Notes:

TOC = Top of Casing
AMSL = Above Mean Sea Level
Water levels measured April 4, 1995.

1.2.2 Areal Extent

The areal extent of the soils impacted by VOCs is presented on Figure 1-8. The boundaries of this area are defined on the north and east by PID detections during excavation for metals impacted soils during stabilization activities. The area to the south is bounded by the hill slope (assumed to be a boundary), and to the west by soil samples taken during the installation of monitoring well MW-6D (now abandoned). This area represents approximately 14,600 square feet with a total relief of about 8 feet.

1.2.3 Depth

The depth of impacted soils is assumed to extend to the ground water surface, based on detections of VOCs in monitoring wells MW-2 and MW-6. A water table surface map (Figure 1-6) was prepared using water levels measured in April 1995. Depth to water and water level elevations are summarized on Table 1-8.

1.2.4 Volume

Soil volume was estimated using the maps described above. Topographic and potentiometric data were digitized for input to Surfer, a contouring program with volume calculation capabilities. The data files were gridded using Surfer, then the grid files were edited to remove extraneous boundary information. The two files were then subtracted to arrive at a volume estimate of 5,800 cubic yards.

2.0 SOIL REMEDIATION CRITERIA

In evaluating the effectiveness and implementability of various alternatives, soil cleanup objectives are necessary to assess the relative applicability of various technologies. While standards are usually readily available for ground water remediation, soil cleanup is often less well defined. Depending on the remedial technology selected, three criteria are considered as potentially applicable to the site as soil remediation objectives. The first is the New York State TAGM entitled Determination of Soil Cleanup Objectives and Cleanup Levels, dated January 24, 1994. The second set of criteria are RCRA TCLP standards, which are used to determine whether a material exhibits hazardous characteristics and the third set of criteria are RCRA Universal Treatment Standards (UTS), which are used to determine whether a material can be landfilled. A final determination of the appropriate cleanup objectives is dependant on the type(s) of technology selected. Once the preferred alternative is agreed upon, the actual cleanup targets to be used will be specified in a Remedial Action Plan. Potentially appropriate standards are discussed below.

2.1 New York TAGM Cleanup Objectives

The NYSDEC has established guidelines for remediation of soils. The following general limits on total concentrations apply to any soil.

Constituent	No greater than (mg/kg)
Total VOCs	10
Total Semi-VOCs	500
Individual Semi VOCs	50

Levels also are established for many individual organic and inorganic compounds. These individual soil remediation levels are health-based goals which take into account direct exposure to the soils and the potential impacts to ground water from leaching. The most stringent of the values would apply. If background levels or the method detection limit (MDL) for a compound are above the health based goal, then the higher of the background or MDL becomes the standard.

Generally, for organic contaminants the remedial objective is based on potential threats to ground water. These are calculated first by using applicable ground water standards, which in most cases are Maximum Contaminant Levels (MCLs), and applying a partition coefficient to find the soil concentration in equilibrium with water at the standard. Then an attenuation factor of 100 is applied to the soil levels to account for volatilization, sorption, diffusion, transformation, and degradation as a compound travels through the vadose zone. For inorganic contaminants, the remediation level is usually based on background levels. The state can review these assumptions and determine if they need to be modified for a specific site.

The state has approved cleanup goals for cadmium, chromium and lead in this part of the site. These goals are described in the Interim Remedial Measures Remedial Action Plan (HSI, 1994) and are 10 mg/kg, 17 mg/kg and 30 mg/kg for cadmium, chromium and lead, respectively. Additionally, approved cleanup levels for TCLP leachate from stabilized soils to be backfilled were set at 0.01 mg/l for cadmium, 0.05 mg/l for chromium and 0.05 mg/l for lead.

Table 2-1 shows potentially applicable soil remediation objectives for total concentrations of the compounds detected in the soils. Semi-volatile organic compounds are not tabulated because all sample concentrations have been below individual and total SCGs. Table 2-1 presents TCLP concentrations from soil sample V3-175N,80E, collected near the former chemical storage building. The laboratory report for this sample is included in Appendix A. Results from this sample are compared with RCRA TCLP hazardous concentration levels from 40 CFR Part 261.24.

2.2 RCRA Guidelines on Hazardous Waste and Land Disposal

Soil concentration information indicates that if the soil were removed (for ex-situ treatment or off-site disposal), it may be a RCRA characteristic waste based on several organic and inorganic

TABLE 2-1

TOTAL CONSTITUENT CONCENTRATIONS AND POTENTIALLY APPLICABLE STANDARDS

Constituent	Maximum Detected Soil Concentration (μg/kg)	NYS TAGM Soil Cleanup Objectives to Protect Ground Water (μg/kg)	RCRA UTSs Total Concentration (μg/kg)	Soil TCLP Concentrations (μg/L)	RCRA Allowable TCLP Concentrations (μg/L)
1,2-Dichloroethene	19	300 (2)	NS	<5	700
1,2,4-Trimethylbenzene	1,000	NS	NS	NA	NS
1,3,5-Trimethylbenzene	460	NS	NS	NA	NS
Benzene	7,900	60	10,000	<5	500
Chlorobenzene	18,000	1,700	6,000	<5	100,000
Ethylbenzene	18,000	5,500	10,000	NA	NS
Isopropylbenzene	1,200	NS	NS	NA	NS
Methylene Chloride	(1)	100	30,000	NA	NS
n-Propylbenzene	790	NS	NS	NA	NS
Tetrachloroethene	6	1,400	6,000	<5	700
Toluene	6,800	1,500	10,000	NA	NS
Trichloroethene	5,600	700	6,000	<5	500
Xylenes	204,000	1,200	30,000	NA	NS
Cadmium	1,260,000 (7)	10,000 (3)	(4)	2,260 (5)	1,000 (6)
Chromium	116,000 (7)	18,000 (3)	(4)	ND (5)	5,000 (6)
Lead	890,000 (7)	30,000 (3)	(4)	723 (5)	5,000 (6)

Notes: NS indicates that no standard for this compound has been specified.
NA indicates that it is not applicable since there are no TCLP standards.
ND indicates that the analyte was not detected.
< indicates the compound was not detected at the listed MDL.

(1) Methylene Chloride has been detected in soil gas but not in soil samples.

(2) NYS TAGM for trans-1,2-Dichloroethene, no standard exists for total 1,2-Dichloroethene.

(3) Cadmium, chromium and lead levels are site specific concentrations approved by NYSDEC and specified in the Interim Remedial Measures Remedial Action Plan (HSI, 1994).

(4) UTSs for Cadmium, Chromium, and Lead are based on TCLP concentrations, not total concentration.
Values shown in ( ) denote the UTS values for cadmium, chromium, and lead in a TCLP test.
Analyses are for Sample No. V3-175N,80E.

(5) Soil TCLP values for Cadmium, Chromium and Lead are from sample V3-175N.

(6) Allowable TCLP concentrations for stabilized soils at the Prestolite site, described in Interim Remedial Measures Remedial Action Plan, Prestolite Plant, Arcade, New York (HSI, November 17, 1994).

(7) Cadmium, Chromium and Lead soil concentrations from samples SG-22, SG-26 and SG-30, respectively, described in Section 1.1.3 of this report.

constituents (the actual source of the soil contamination cannot be traced). To make this determination, a TCLP test was necessary and the values compared to criteria listed in 40 CFR Part 261.24. The fifth column in Table 2-1 shows these levels.

For those wastes which do exhibit the characteristic of toxicity, RCRA further regulates the treatment and disposal of these wastes by application of the land disposal restrictions (LDRs). For those wastes which exhibit the characteristic of toxicity via the TCLP as described above, RCRA generally requires that the waste be treated to meet the Universal Treatment Standards (UTSs) listed in 40 CFR Part 268.48. For organic constituents, the UTSs are based on total concentrations within the waste as opposed to the TCLP leachate concentrations used to determine if the waste is hazardous. The organic compound UTSs which apply to the constituents identified in the soil at the Arcade facility are also listed in Table 2-1.

2.3 Comparison of Soil Concentrations to Guidelines

The specific standards which may apply require assessment of site-specific conditions and selected treatment technologies. However, RCRA TCLP standards are applicable to soils that are treated ex-situ (i.e., excavated for treatment), and to protect ground water, TCLP leachate from these soils should also pass drinking water standards. Finally, UTS concentrations are applicable to any excavated soils before they are backfilled on site or transported off site for landfilling. A final determination of the cleanup objectives is dependant on the type(s) of technology selected. Once the preferred alternative is agreed upon, the actual cleanup targets to be used will be specified in the Remedial Action Plan.

3.0 REMEDIAL OBJECTIVES AND SCREENING OF TECHNOLOGIES

New York State guidance indicates that when evaluating remedial options for a site specific situation, some general remedial objectives should be determined in order to provide a framework for evaluating technologies and alternatives for the contaminant problem. The guidance further states that screening should be conducted throughout the assessment of options based on the anticipated and proven effectiveness of the remedy and factors associated with the implementability of an option such as ease of operation, potential short term hazards, time required to remediate, etc.

3.1 Remedial Objectives

Remedial objectives are formulated to address both protection of health and the environment and attainment of applicable cleanup goals. In this case there are no directly applicable standards governing the cleanup. While some health based guidelines are available for soil remediation in New York State, the applicability of those guidelines will depend on site-specific geological/hydrogeological circumstances and the capability of the available technologies to treat the impacted soil. The general remedial objectives for this project are:

- To meet applicable RCRA requirements for treatment and disposal;
- To minimize the potential for direct contact with soils above the health-based goals; and
- To minimize the migration of organic and inorganic constituents from the treated soil to the ground water.

Because there is a regulatory preference for leaving the soil on-site rather than transport to and disposal at an off-site location, the treatment methods must also be evaluated with respect to their ability to minimize the risk posed to human health and the environment as measured by the general standards listed in Section 2.0. The final determination of cleanup goals will be based on technological capabilities, site-specific conditions and site specific attenuation factors.

New York State guidance indicates that when evaluating available remedies, certain options are generally more attractive than others. These preferences, from most attractive to least attractive, are.

1) Destruction,
2) Separation,
3) Solidification,
4) Containment, and
5) Off-Site Disposal.

3.2 Technology Evaluation

The soils which are the subject of this evaluation have been disturbed by construction and disposal activities conducted prior to water treatment plant construction and are contaminated with organics, most of which are volatile, and some inorganics. The volume of soil requiring treatment (estimated in Section 1.2) is 5,800 yd^3, as measured in-situ. The volume increase upon excavation is assumed to be approximately 25%, resulting in a volume of 7,250 yd^3. Assuming that the in-situ soil bulk density is approximately 95 lb/ft^3, the total weight of affected soil would be 7,450 tons.

Three general categories of technologies are potentially applicable to the Arcade site. Some treat only organic contamination, some treat only inorganic contamination, and some innovative technologies may treat both in a single operation. The first two categories of technologies include both in-situ and ex-situ technologies which are used to treat only organics or only inorganics. The third category considers combinations of applicable technologies from the first two categories or innovative single operation technologies to treat organic and inorganic soil contaminants at the site.

The third category (technologies that may be able to treat both organic and inorganic contaminants simultaneously) includes some technologies that are considered innovative since they are not yet in widespread use and therefore are not "proven". Others utilize on-site containment or off-site disposal. Appendices C, D, E and F provide brief review memos of the technologies considered for this particular application.

3.2.1 Remediation of Organic Contaminants

Five technologies have been identified as potentially applicable to removal of the organics from the soils. They include both destruction technologies and separation technologies.

3.2.1.1 Soil Vapor Extraction (SVE)

SVE utilizes the volatility of the contaminants to remove them from the soil matrix. A flow of air is induced through the soil pore spaces and the contaminants are removed through a combination of volatilization, diffusion, and advection. For an in-situ system, a vertical or horizontal well is installed in the soil and an above-ground blower is used to create a vacuum in the well, thus drawing air from the surface through the soil and into the well. The contaminated air stream is treated, as necessary, to comply with air emission regulations. For an ex-situ system, the soil is typically piled onto a slotted horizontal pipe which is connected to a vacuum blower identical to the in-situ system.

The technology is well developed and has been used at numerous sites in various types of soils. The technology does not work for compounds with low volatilities in water nor does it work well in very tight soils. Standard equipment as utilized and SVE systems generally operate very reliably with little oversight.

Table 3-1 lists some organic compounds detected in soils at the site and the corresponding volatilities of these compounds as measured by the Henry's constant. Compounds with volatilities which exceed 100 atm-m^3_{water}/m^3_{air} are generally considered good candidates for SVE. As shown in the table all of the compounds identified at the site are amenable to SVE. An SVE system is already in operation and successfully removing volatile contaminants under the Prestolite manufacturing building. The soils are permeable enough to support this

TABLE 3-1

CHARACTERISTICS OF ORGANIC CONTAMINANTS

Constituent	Henry's Constant	Biodegradability
Trichloroethene	544	P, D
Toluene	217	D
Benzene	230	D
Ethylbenzene	359	D
Xylenes	266	D
Chlorobenzene	145	D

(Henry's Constant units are atm-m^3_{water}/m^3_{air})

Notes:
1. Information taken from Practical Techniques for Groundwater and Soil Remediation, E.K. Nyer, Lewis Publishers, 1993
2. Henry's Constants @ 68°F
3. P = Persistent
   D = Degradable

technology either in-situ or ex-situ. Therefore, SVE technology is retained for further consideration.

3.2.1.2 Biological

Biological treatment takes advantage of the ability of microbes to degrade organic compounds either as a substrate or through co-metabolism. The technology can be implemented in-situ by circulating the necessary nutrients (nitrogen, phosphorous, oxygen, etc.) through the subsurface to stimulate microbial degradation. The two most common applications are bioventing, which utilizes an SVE system to provide oxygen and can be supplemented with fertilizer to provide nutrients, and a full-scale biological treatment system in which a controlled volume of water containing nutrients necessary to stimulate biodegradation is circulated through the impacted soils. Biological treatment can also be implemented ex-situ on soils using a slurry reactor in which soils are mixed with water and other nutrients, or in engineered biopiles where the soil is tilled to provide the necessary mixing.

The advantages of a biological system are low cost, the destruction of the contaminants, and the simplicity of the treatment. Disadvantages include the varying biodegradability of many contaminants, the potential that nutrients can also be considered contaminants (i.e. nitrate), the potential for harmful degradation products, and the inability to meet low treatment levels.

Table 3-1 lists the general biodegradability of the compounds found at the site. While most are readily biodegradable, TCE is relatively recalcitrant. Another factor which makes this technology difficult to use in this case is that the metals will inhibit biological activity. As noted in Appendix C, many vendors providing this technology indicate that the metals must be removed prior to attempting biological treatment. The potential for unwanted degradation byproducts also exists. The degradation of chlorinated compounds such as TCE can produce vinyl chloride, a more toxic compound. Some technologies do exist which successfully have degraded TCE without the formation of vinyl chloride, however, the subsurface conditions have to be ideal and the mixture of "additives" strictly monitored and controlled.

In-situ treatment through circulation of nutrient-enriched water could potentially impact the shallow ground water system beneath the site and would require very careful control. Therefore, in-situ biological treatment will not be considered further for use at the site. While bioventing is proven effective for VOCs, the inhibitory effect of the metals in the soil renders in-situ treatment not applicable. Therefore, bioventing will not be considered except as a supplement to SVE, which is retained for analysis.

Based on discussions with a number of qualified and experienced vendors, ex-situ treatment could be considered but only if the metals can be removed first. Even if the metals can be removed to non-inhibitory levels, the issue of whether vinyl chloride is produced must be addressed. As noted above and in Appendix C, several vendors are confident that vinyl chloride can be avoided; however, bench tests would be necessary to confirm that this is a viable treatment method. Ex-situ biological treatment will be retained as an applicable treatment method but only as a second stage treatment after the inorganics have been addressed.

3.2.1.3 Thermal Desorption

Thermal desorption refers to the process of applying heat to the contaminated soils to volatilize the organics. The gaseous contaminants are removed from the heating unit, sometimes using a gas carrier which may be steam or N_2, and condensed for collection and proper disposal. The technology differs from incineration in that the temperatures are substantially lower and the contaminants are not burned or oxidized.

Several vendors provide thermal desorption units. The technology has emerged in the last two to three years from the bench and pilot scale to full-scale remediation. The technology has been used for remediation at NPL sites including Acme Solvents and Waukegan Harbor in Illinois, Re-solve in Massachusetts, and Wide Beach in New York, as well as being used at numerous other sites around the country. Fine soils and dust can cause problems with the technology. High moisture content can cause the costs to increase significantly. Feed material must usually be two inches or smaller.

The organic contaminants will all be readily removable using this technology. However, units are generally capable of handling 100 to 200 tons per day. For a soil mass as small as the estimated 9,400 tons at this site it may not be economical to use this technology. However, because it is proven and effective it is retained for further analysis. Thermal desorption is further discussed in Appendix D.

3.2.1.4 Solvent Extraction

This technology utilizes a solvent to preferentially dissolve contaminants from the soil matrix. The solvent is added to the soil and mixed vigorously. The soil is then allowed to settle and the contaminant-laden solvent is decanted. Distillation, pressure flashing, heat or some combination of unit operations, depending on the solvent, is used to separate the solvent and produce a contaminant stream for disposal. The solvent is recycled. The soil is dried to remove the solvent.

Solvent extraction is marketed by several vendors, but has not been widely used for full-scale remediation. Fines can cause problems in the processing steps, the solvent may be considered a pollutant itself, solids processing to attain relatively small feed particles (1/4 inch minus) is necessary, and mixing efficiency is critical to the extraction of the contaminants.

Testing is normally required to establish the applicability of the solvent used and determine the number of washing steps necessary to achieve standards. Since this technology has little or no full-scale application, this technology will not be evaluated further.

3.2.1.5 Incineration

Incineration utilizes high temperatures to burn and oxidize the soil and contaminants. The soil is fed into a high temperature furnace which may be heated by a direct flame or with infra-red heat elements. The organics either are oxidized or vaporized in this step. The gases produced are usually subjected to higher temperatures in a secondary chamber to complete the oxidation process. Emissions are normally controlled using sophisticated scrubbing equipment, and treatment of the generated water.

Incineration is a commercially proven process for destruction of organic contaminants. However, the byproducts of combustion can often make this process unattractive and the metals existing in the soil mass will require treatment in the combustion residual. Lengthy permitting and test burns are normally required. The complexity of the incineration process and peripherals makes this technology uneconomical for all but the largest sites. Therefore, incineration is not considered further.

3.2.2 Remediation of Inorganic Contaminants

Two technologies are considered as potentially applicable to the soils for treatment of the inorganics.

3.2.2.1 Stabilization/ Solidification

In this process the soil is mixed with an agent designed to bind the metals within the matrix. The two most commonly used additives are based on Portland cement or lime. Both are capable of binding many inorganics. The inorganics are rendered less leachable due to both physical binding within the matrix as well as chemical changes. In many instances vendors of these technologies add proprietary reagents to the mix to aid in the binding process and more efficiently reduce leaching of inorganics.

This technology is readily available and proven in this application. Approximately 13,000 cubic yards of material were successfully treated adjacent to the VOC and metals impacted soils at the Prestolite site with an approximate 15 percent mixture of Portland cement. During this operation, samples were collected from each 100 cubic yard process batch for analysis of TCLP cadmium, chromium and lead. None of the batches failed to pass TCLP standards. During the operation, a volumetric expansion factor of approximately 10 to 15 percent was observed. Because this technology has proven effective at the site, it is retained for further consideration.

3.2.2.2 Soil Washing

Soil washing to treat inorganics is based on the premise that the majority of the contaminants reside in the finer fraction of the soil matrix. By separating the finer fraction, the majority of the contaminant can be isolated for disposal. Much work has been done in Europe to commercialize this process and it has recently been used in the U.S. to remediate sites.

The particle size distribution and the spread of contaminants within that distribution is critical to the applicability of this technology. The percentage of silt and clay will determine the volume reduction of soil achievable which, in turn, greatly affects the economics of the process. The contaminant content in the sand fraction will determine whether additional processing is needed and the treatment efficiency of the process. The presence of soluble organics can contaminate the circulating water used within the unit. This would require a water treatment step.

The particle size information available from site samples indicates that a volume reduction of approximately 50% can be expected. While this is less than ideal, the existing case-study data indicates that this technology is applicable to removal of inorganics and is retained for that purpose.

The presence of organics in the soil complicates use of this technology both because VOCs can volatilize from the processing equipment and because the organics can dissolve in the water, contaminating clean soil fractions and equipment. Many of the organics at this site are volatile and are soluble to some extent, thus they may become dissolved within the water used in the unit. While some additional processing of the water may be necessary to deal with this problem, there appears to be little experience with modifying or altering the process for this condition. The possibility of using this technology for simultaneous treatment of organics and inorganics is considered further in Section 3.2.3. Soil washing technology for inorganics is retained, but only as a second stage treatment. The organic concentrations must be reduced prior to implementing soil washing for removal of inorganics.

3.2.3 Simultaneous Remediation of Organics and Inorganics

3.2.3.1 Stabilization

While stabilization is used mainly to immobilize inorganic species in soils, some vendors claim that organics can be immobilized or remediated simultaneously with inorganics. Appendix E presents a summary of information obtained from vendors related to the capability and applicability of stabilization. Some vendors claim that proprietary additives either bind or degrade organics sufficiently to prevent leaching. Others claim that the heat generated from the solidification/stabilization process volatilizes the organics. Tests have already been completed at the site which indicate that simply stabilizing the soil does not produce sufficient heat to remove the organics to acceptable levels. Unfortunately, none of the vendors could provide specific test or site information for constituents and concentrations similar to those at this site to verify the ability of the technology to simultaneously treat the organics and inorganics in the soils. Several offered to perform treatability studies to verify their claims. However, without some more specific test data to substantiate the claims, there is little reason to believe that these technologies will be able to achieve reduction of organics which would comply with applicable standards. Therefore, this option is not retained for detailed analysis.

3.2.3.2 Soil Washing

Soil washing is used mainly for segregation of inorganics from a soil matrix. Several vendors claim the technology is applicable to treating organics by dissolving organics from the soil matrix and treating the water to remove or destroy the organic contamination. Appendix F presents information obtained from vendors related to the possibility of using soil washing at the site. Only one provided information related to treating volatile/soluble organics in a soil washing situation. However, the treatment which has been used is ultimately a biological process. As noted earlier, biological treatment is inhibited by the inorganics present in this soil and is not applicable as a treatment unless the inorganics are removed. Thus, no real evidence exists that soil washing can treat the combination of organics and inorganics in this soil in one step. Therefore, this option is not retained for further consideration.

3.2.3.3 Containment

The containment option considered for this site is a single layer cap designed to prevent direct exposure to the soils and to reduce infiltration into the soil and, thus, minimize the potential for leaching to the ground water. In accordance with NYS administrative code section 360-2.15 on landfill closure and section 360-2.13 (q) on cover system design, the cap would consist of 18 inches of compacted clay (with a permeability of 1×10^{-7} cm/sec or lower) overlain by a 24-inch soil barrier layer, overlain by a 6-inch topsoil layer. The cover must have a minimum slope of 4 percent.

Implementing this remedy on-site is possible assuming that a reasonable clay source can be found locally. Capping of this type is normally used for much larger sites. The cap would require that future uses of the property be restricted so as not to interfere with the ability of the cap to isolate the waste and reduce infiltration. While the cover system described would be expected to reduce infiltration on the order of 70 to 90%, it does not eliminate infiltration entirely. Thus its effectiveness in protecting ground water must be carefully evaluated prior to and after implementation. Finally, the cap would require continual maintenance and monitoring to ensure its effectiveness.

Capping of this sort is a proven technology which can be implemented. Because this option can be effective and is implementable, it is retained for further analysis.

3.2.3.4 Off-Site Disposal

This option includes the excavation of the material and shipment to an off-site disposal facility. Because testing indicates that the waste is a characteristic hazardous waste under RCRA due to at least cadmium, treating the excavated soil to UTSs will be necessary. This can be accomplished using stabilization technology which could be implemented either on-site or at the disposal facility. It is assumed that the presence of the organics may make this option more difficult to implement even when in compliance with UTSs because disposal facilities may not accept the material. The disposal facility must be a permitted RCRA hazardous waste landfill.

This option has been utilized for wastes during previous work at the facility. Costs are readily available and it is known to be a feasible option. This option may also be utilized in concert with other options to dispose of wastes created during other treatment activities.

3.2.4 Summary of Technology Screening

Table 3-2 lists the technologies that were identified as potentially applicable to the Arcade site and screens them based on effectiveness and implementability. Those technologies identified as applicable in this screening are retained for further evaluation in the following sections.

TABLE 3-2

SOIL RESPONSE ACTIONS

Type	Technology	Process Options	Description	Screening Comments
Organic Contaminants				
In-Situ	Separation	Soil Vapor Extraction	Typical SVE with wells and above ground blower.	Applicable to organics at site. Retained for consideration.
	Destruction	Biological	Requires circulation of microbes, water, and nutrients through vadose zone with GW extraction.	Potential contamination of GW – not applicable. Screened from further consideration.
Ex-Situ	Separation	Soil Vapor Extraction	Construct soil piles around horizontal pipes with blowers to extract air.	Applicable to organics at site. Retained for consideration.
		Thermal Desorption	Use heat to volatilize organics and condense for disposal.	Applicable to organics at site. Retained for consideration.
		Solvent Extraction	Use solvent to remove organics. Recover organics and recycle solvent.	Not proven – not applicable. Screened from further consideration.
	Destruction	Incineration	Oxidize organics at high temperatures.	Cannot be justified at this site. Screened from further consideration.
		Biological	Use slurry reactor or engineered piles to degrade organics.	Applicable if organics are removed first. Conditionally retained for consideration.
Inorganic Contaminants				
Ex-Situ	Stabilization	Concrete-Based	Use concrete to immobilize inorganics.	Applicable to inorganics at site. Retained for consideration.
		Lime-Based	Use lime to immobilize inorganics.	Does not bind lead – not applicable. Screened from further consideration.
	Separation	Soil Washing	Separate inorganics based on particle size.	Applicable to inorganics if inorganics are removed first. Retained for consideration.
Dual Organic/Inorganic Treatment				
Ex-Situ	Solidification	Concrete-Based	Use concrete to immobilize inorganics and organics.	Applicable to inorganics at site after VOCs are removed. Retained for consideration.
		Lime-Based	Use lime to immobilize inorganics and organics.	Does not bind lead – not applicable. Screened from further consideration.
	Separation	Soil Washing	Separate inorganics based on particle size and treat inorganics as they are dissolved.	Insufficient data on effectiveness – not applicable. Screened from further consideration.
Off-Site Disposal		Excavate, Treat & Dispose	Excavate soils, treat to UTSs and dispose off-site.	Applicable. Retained for consideration.
On-Site Disposal	Containment	Capping	Cover the affected soils to reduce infiltration and exposure.	May be effective. Retained for further analysis. Retained for consideration.

4.0 SCREENING AND DESCRIPTION OF ALTERNATIVES

4.1 Compiling and Screening of Technologies

Based on the technology screening presented in Section 3.0, four organic treatment options were retained; in-situ SVE, ex-situ SVE, ex-situ biological and thermal desorption. Two inorganic treatment options were retained; stabilization and soil washing. Capping and off-site disposal were the only two viable technologies for dealing with both VOC and metals contaminants concurrently. In assessing potential combinations of these technologies, the order in which treatment takes place, and the impacts one treatment technology may have on the subsequent operation, must be considered.

Table 4-1 provides a summary of technology combinations which were considered for further screening based on the criteria presented in this section. It also shows those alternatives which are being screened from further consideration for reasons described below.

- As noted in the technology discussion in Section 3.0, several technologies were not considered appropriate as a first treatment step. For instance, in-situ SVE would not be appropriate as a second step after excavation had already occurred.

- As discussed in Section 3.2.1.2, ex-situ microbial growth would be inhibited by metals in the impacted soils, therefore, biological treatment could only be combined with a technology which first removes the inorganics. Thus, stabilization could not be combined with biological treatment since the inorganic contaminants remain in the soil matrix. The only technology available to "remove" inorganics is soil washing, however, soil washing suffers from several drawbacks as an initial treatment step. Soils at the site are comprised of a high percentage of fines (up to 50 percent), which would result in an excessive volume of residual material. Additionally, organic contamination in the soils would require secondary treatment of the soil wash water. Therefore, soil washing cannot be reliably used as an initial treatment step. In the absence of a reliable step to remove the inhibitory inorganic contamination, there is no application for biological treatment at the site.

TABLE 4-1

ARRAY OF REMEDIAL ALTERNATIVES

Technology	Alternatives						
	A	B	C	D	E	F	G
In-Situ SVE	1	1					
Ex-Situ SVE			2				
Ex-Situ Thermal Desorption				1	1		
Solidification/Ex-Situ Stabilization	2		1	2			
Ex-Situ Soil Washing		2			2		
Capping						1	
Off-Site Disposal							1

Notes: "1" represents the first stage of the remediation.
"2" represents the second stage of the remediation.
Shading indicates those alternatives which are screened from further consideration.

The alternative utilizing stabilization followed by SVE was also screened from further consideration. Stabilization is viable as a first stage treatment step, but the physical and chemical characteristics of the stabilized soils have not been quantified at the site and potential interferences from changes in the treated soil matrix could render this combination of technologies ineffective. Pilot testing of this combination would be necessary to determine the overall effectiveness of these two technologies implemented in this manner. Furthermore, the option to perform SVE first followed by stabilization still exists. By implementing SVE first, followed by stabilization, the relative performance of the technologies can more easily be estimated. Thus the more easily implementable combination is retained while the other is screened from further consideration.

The alternative utilizing thermal desorption followed by soil washing was also screened from further consideration. The thermal desorption process requires extensive materials handling. Because of this handling, the treated material from the desorber will contain a greater percentage of fines than the feed material. Soil washing relies on minimizing the fine material to perform an economical separation of the inorganics in the fines from the sand and gavels. Thus, the thermal desorption step proves detrimental to the soil washing separation effectiveness. Therefore, this combination of technologies is not an effective means of treating the soils and is screened from further consideration.

4.2 Description of Alternatives

Five alternatives have been retained for further analysis. These are:

1) Alternative A: In-Situ SVE and Ex-Situ Stabilization
2) Alternative B: In-Situ SVE and Ex-Situ Soil Washing
3) Alternative D: Ex-Situ Thermal Desorption and Stabilization
4) Alternative F: Capping
5) Alternative G: Excavation and Off-Site Disposal

A more detailed analysis of each alternative is provided below.

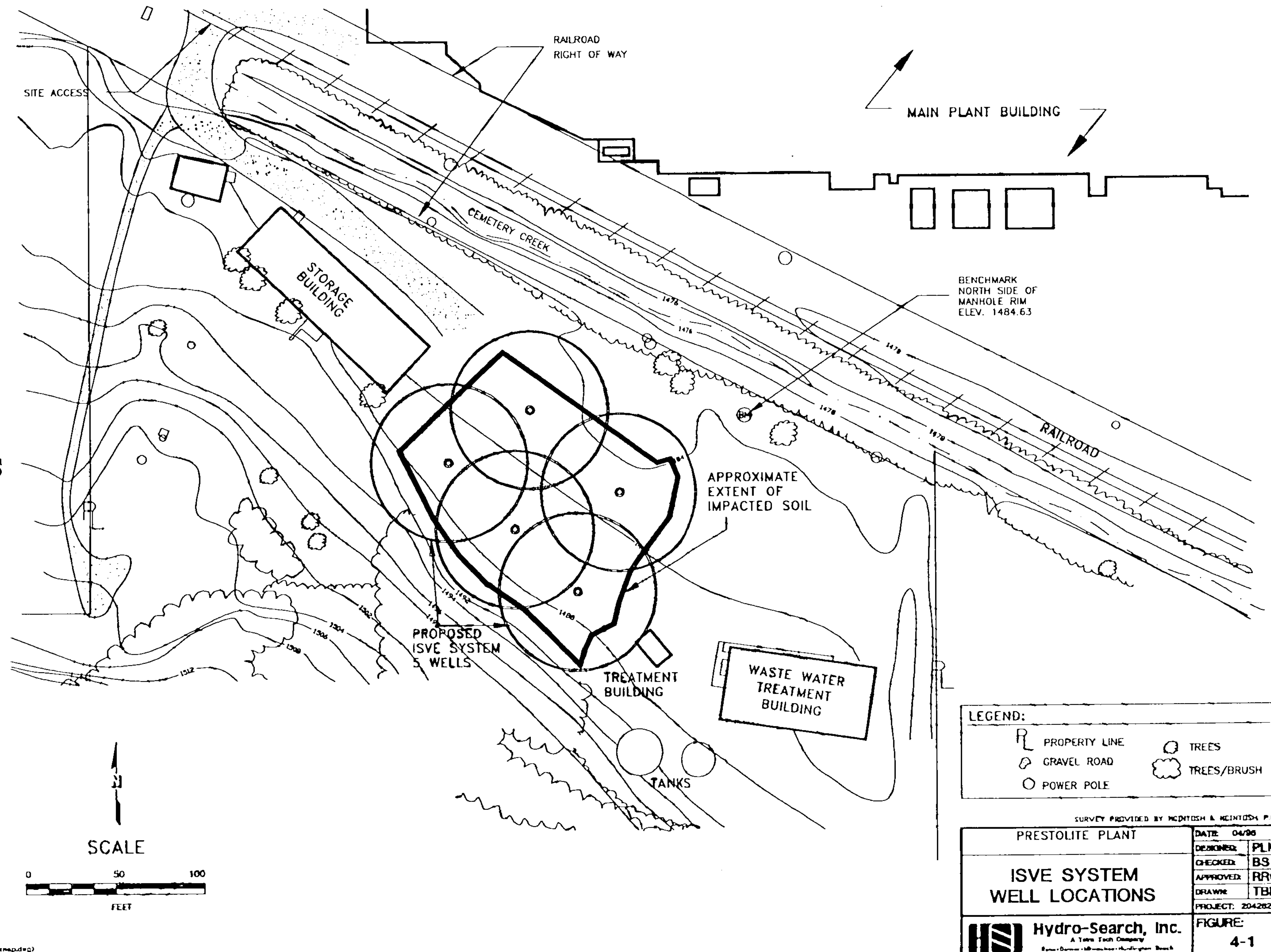
4.2.1 Alternative A: In-Situ SVE and Ex-Situ Stabilization

The initial treatment step under this alternative is to implement an in-situ SVE system within the affected area. As shown in Figure 4-1, this is estimated to require five vapor extraction wells situated around the site, each with a radius of influence of 40 feet. This estimate is based on the currently operating SVE system beneath the Prestolite plant building and accounts for the absence of the plant building floor in the area to be remediated. It also includes an approximate overlap of 25 percent for each well.

Preliminary calculations indicate that the flow from each well would be approximately 20 standard cubic feet per minute (scfm). One blower sized to handle 150 scfm at a vacuum of approximately 8 inches of mercury would be installed above ground (Johnson, et. al., 1990). Using soil gas data collected from around the former chemical storage building, potential emissions were estimated at 2.5 lb/hr. Treatment of emissions is not mandated under NYS regulations and is not assumed in this analysis. However, treatment of emissions may be required at the discretion of the regulatory agency as part of the permitting activities associated with the remedy.

The SVE system would be operated until organic concentrations in the effluent dropped to a level which indicated that soil concentrations had been reduced to acceptable levels. This will require that the system be shutdown periodically and soil gas concentrations monitored to determine if they will rebound to a higher level. When soil gas concentrations are found to be acceptable, then actual soil samples would be collected before and during excavation.

Predicting when the bulk concentrations of the soil will meet acceptable levels is difficult since cleanup goals have not been established and, more importantly, because contaminant transport in the subsurface cannot be ascertained with the certainty required to accurately predict a cleanup time frame. Experience with similar systems indicates that cleanup levels in the range of those established by the NYS TAGM can usually be achieved in 6 months to 2 years after removal of 300 to 1,000 pore volumes of air. The system as described above will remove approximately



53

PRESTOLITE PLANT	DATE: 04/96
ISVE SYSTEM WELL LOCATIONS	DESIGNED: PLM
	CHECKED: BS
	APPROVED: RRG
	DRAWN: TBL
	PROJECT: 204282069
Hydro-Search, Inc. A Tetra Tech Company	FIGURE: 4-1

2 to 3 pore volumes of air each day in the impacted area. Thus, for purposes of this analysis, the period of operation of the SVE system has been estimated to be one year.

Following completion of the SVE remedy, the soil in the affected area would be excavated and stabilized. For the estimated volume of soil, the stabilization operation would require approximately 8 weeks (27 tons/hr, 10 hrs per day, 90 percent utilization with 3 weeks for mobilization/demobilization). Several viable candidates for this treatment are known including the stabilization technology used previously at the site. For purposes of evaluating this option, costs and other information obtained during the previous effort and from the solidification technologies listed in Appendix E are used. Based on site experience, 10 to 15 percent volume increase is assumed and a cost of $65/ton is considered representative for stabilization. While soil bulking and the addition of a stabilizing agent will result in greater soil volume, the excess stabilized soil will be placed on-site between the toe of the slope to the south and the location of the former chemical storage building. Any excess stabilized soil that cannot be backfilled on-site will be taken to a non-hazardous Subtitle D disposal facility. To present a conservative estimate, off-site disposal of 30 percent of the material is included in the costs for this alternative. Total costs for this alternative are included in Table 4-2.

4.2.2 Alternative B: In-Situ SVE and Ex-Situ Soil Washing

This alternative includes implementation of an SVE system identical to that described in Alternative A. Costs for that portion of the remedy would also be identical. However, under this alternative, the soil would be excavated and processed in a soil washing unit designed to reduce the inorganic concentrations in the soil. The soils will be screened prior to being fed into the unit but no additional material handling has been included to meet the 2-inch minus feed requirement. Based on particle size distributions from the site, a volume reduction of 50% could be expected. Thus, 50% of the 7,450 tons (or 3,725 tons) of the material with a maximum dimension of 2 inches or less would require off-site disposal. Because this soil residual would contain the inorganics in concentrated form, disposal as a hazardous waste is assumed. The remaining clean material would be backfilled into the excavation with enough clean borrow

TABLE 4-2

ESTIMATED COSTS FOR ALTERNATIVE A: IN-SITU SVE AND EX-SITU STABILIZATION

UPFRONT COSTS

In-Situ Soil Vapor Extraction

Site Work		
Site Preparation	$1,000	From Means
Concrete	600	From Means
Buildings	3,500	Vendor Information
Treatment		
Well Installation	6,300	70 feet @ $90/ft
Blower and Separator	15,000	Vendor Information
Piping, Electrical, Instruments	10,000	Engineers Estimate
Yard Piping	4,100	From Means
Other		
Health and Safety	4,050	10% of DC
Confirmation Sampling	6,000	20 SVE gas @ $150/each, 20 soil @ $150/each
Direct Costs (SVE)	**$50,550**	

Ex-Situ Stabilization

Site Work		
Site Preparation	$1,000	From Means
Excavation	29,000	$5/cu yard
Treatment		
Mob./Demob.	50,000	Vendor Quote
Stabilization	483,503	Vendor Quote $65/ton
Other		
Health and Safety	33,156	5% of DC
Air Monitoring	4,500	$1,500/month
Disposal	50,210	Vendor Quote $45/ton, 15% disposal
Backfill/Revegetation	29,000	$5/cu yard From Means
Confirmation Sampling	7,500	100 soil @ $75/each
	8,400	70 TCLP @ $120/each
Direct Costs (Stabilization)	**$696,268**	

Bonds	$22,405	3% of DC
Engineering	22,000	Engineers Estimate
Documentation (O&M and Monitoring Plan	25,000	Engineers Estimate
Construction Oversight	50,000	Engineers Estimate
Startup	25,000	Engineers Estimate
Contingency	$149,364	20% of DC
TOTAL UPFRONT COST	**$1,040,586**	

OPERATION AND MAINTENANCE COSTS

Electricity	$3,800	5hp @ 80% utilization and $0.08/KW-hr
Monitoring	12,000	$1,000/month
Maintenance	8,055	$250/month for inspection, 10% of Direct Costs for parts and Misc.
Administration	5,000	Engineers Estimate
TOTAL ANNUAL O&M	**$28,855**	

Project Life: **1 year**

O&M Present Worth $28,855

(2089\alta)

TOTAL PROJECT PRESENT WORTH $1,069,441

(12/12/95)

material to restore the site to its original grade. Following the initial year of SVE treatment, the soil washing could be completed in 15 weeks (10 tons/hr, 10 hrs per day, 90% utilization with 3 week mobilization/demobilization). Costs for this alternative are shown in Table 4-3.

4.2.3 Alternative D: Ex-Situ Thermal Desorption and Stabilization

This alternative requires that the soils be excavated and initially processed through a thermal desorption unit to remove the organics. The excavation activities will require some effort to minimize the impacts to air quality from handling soils with VOCs and a monitoring effort to assess these impacts. Screening of the soils is assumed as the initial step, but no additional materials handling is assumed necessary in order to meet the 2 inch minus feed requirement of thermal desorption.

Because the startup and cooldown of these units is time and energy consuming, these units are run 24 hours a day with only maintenance shutdowns. Approximately 9.5 weeks would be needed to process the waste (10 tons/hour), which includes mobilization/demobilization and 5 days for maintenance shutdown. Based on the organic concentrations noted in Section 2.0, approximately 2.2 tons of material (590 gallons or 11 drums) is assumed to be recovered for disposal. This material will require disposal by off-site incineration.

The remaining soil, free of organics, would then be treated by stabilization to bind the inorganics and prevent leaching. The stabilization process would be identical to that described in Alternative A. Costs are shown on Table 4-4.

4.2.4 Alternative F: Capping

This alternative includes installation of a cap conforming to NYS requirements for a single barrier cover as described in Section 3.3. Some site preparation and grading will be necessary to prepare the soil surface and meet the 4% grade requirement. The soils would be capped with 18 inches of a suitable clay compacted to meet the 1×10^{-7} cm/sec permeability requirement.

TABLE 4-3

ESTIMATED COSTS FOR ALTERNATIVE B: IN-SITU SVE AND EX-SITU SOIL WASHING

UPFRONT COSTS		
In-Situ Soil Vapor Extraction		
Site Work		
Site Preparation	$1,000	From Means
Concrete	600	From Means
Buildings	3,500	Vendor Information
Treatment		
Well Installation	6,300	70 feet @ $90/ft
Blower and Separator	15,000	Vendor Information
Piping, Electrical, Instruments	10,000	Engineers Estimate
Yard Piping	4,100	From Means
Other		
Health and Safety	4,050	10 % of DC
Confirmation Sampling	5,000	Vendor Information
Direct Costs (SVE)	**$49,550**	
Ex-Situ Soil Washing		
Site Work		
Site Preparation	$1,000	From Means
Excavation	29,000	$5/cu yard
Treatment		
Study	1,000	Vendor Quote
Soil Washing	1,041,390	Vendor Quote $140/ton
Other		
Health and Safety	99,996	5% of DC
Air Monitoring	4,500	$1500/month
Disposal	892,620	Vendor Quote $240/ton, 50% disposal
Backfill/Revegetation	14,500	$5/cu yard, 50%, From Means
Confirmation Sampling	7,500	100 soil @ $75/each
	8,400	70 TCLP @ $120/each
Direct Costs (Stabilization)	**$2,099,906**	
Bonds	$64,484	3% of DC
Engineering	22,000	Engineers Estimate
Documentation (O&M and Monitoring Plan)	25,000	Engineers Estimate
Construction Oversight	50,000	Engineers Estimate
Startup	25,000	Engineers Estimate
Contingency	429,891	20% of DC
TOTAL UPFRONT COST	**$2,765,830**	
OPERATION AND MAINTENENCE COSTS		
Electricity	$3,800	5hp @ 80% utilization and $0.08/KW-hr
Monitoring	12,000	$1,000/month
Maintenence	7,955	$250/month for inspection, 10% of DC for parts and misc.
Administration	5,000	Engineers Estimate
TOTAL ANNUAL O&M	**$28,755**	
Project Life: 1 year		
O&M Present Worth	$28,755	
TOTAL PROJECT PRESENT WORTH	**$2,794,585**	

(2089\altb)

TABLE 4-4

ESTIMATED COSTS FOR ALTERNATIVE D: EX-SITU THERMAL DESORPTION AND STABILIZATION

UPFRONT COSTS

Ex-Situ Thermal Desorption

Site Work		
Site Preparation	$1,000	From Means
Concrete	1,000	From Means
Treatment		
Study	6,300	Vendor Quote
Thermal Desorption	743,850	Vendor Quote $100/ton
Other		
Health and Safety	75,215	10 % of DC
Air Monitoring	10,000	Engineers Estimate
Disposal	4,400	Vendor Quote
Backfilling/Revegetation	29,000	$5/cu yard, From Means
Confirmation Sampling	12,000	100 soil @ $120 each
Direct Costs (SVE)	**$882,765**	

Ex-Situ Stabilization

Site Work		
Site Preparation	$1,000	From Means
Excavation	29,000	$5/cu yard
Treatment		
Mob./Demob.	50,000	Vendor Quote
Stabilization	483,503	Vendor Quote $65/ton
Other		
Health and Safety	33,231	5% of DC
Air Monitoring	6,000	$2,000/month
Disposal	50,210	Vendor Quote $45/ton, 15% disposal
Backfill/Revegetation	29,000	$5/cu yard, From Means
Confirmation Sampling	7,500	100 soil @ $75/each
	8,400	70 TCLP @ $120/each
Direct Costs (Stabilization)	**$697,843**	

Bonds	$47,418	3% of DC
Engineering	22,000	Engineers Estimate
Documentation (O&M and Monitoring Plan)	25,000	Engineers Estimate
Construction Oversight	50,000	Engineers Estimate
Startup	25,000	Engineers Estimate
Contingency	316,122	20% of DC
TOTAL UPFRONT COST	**$2,066,148**	

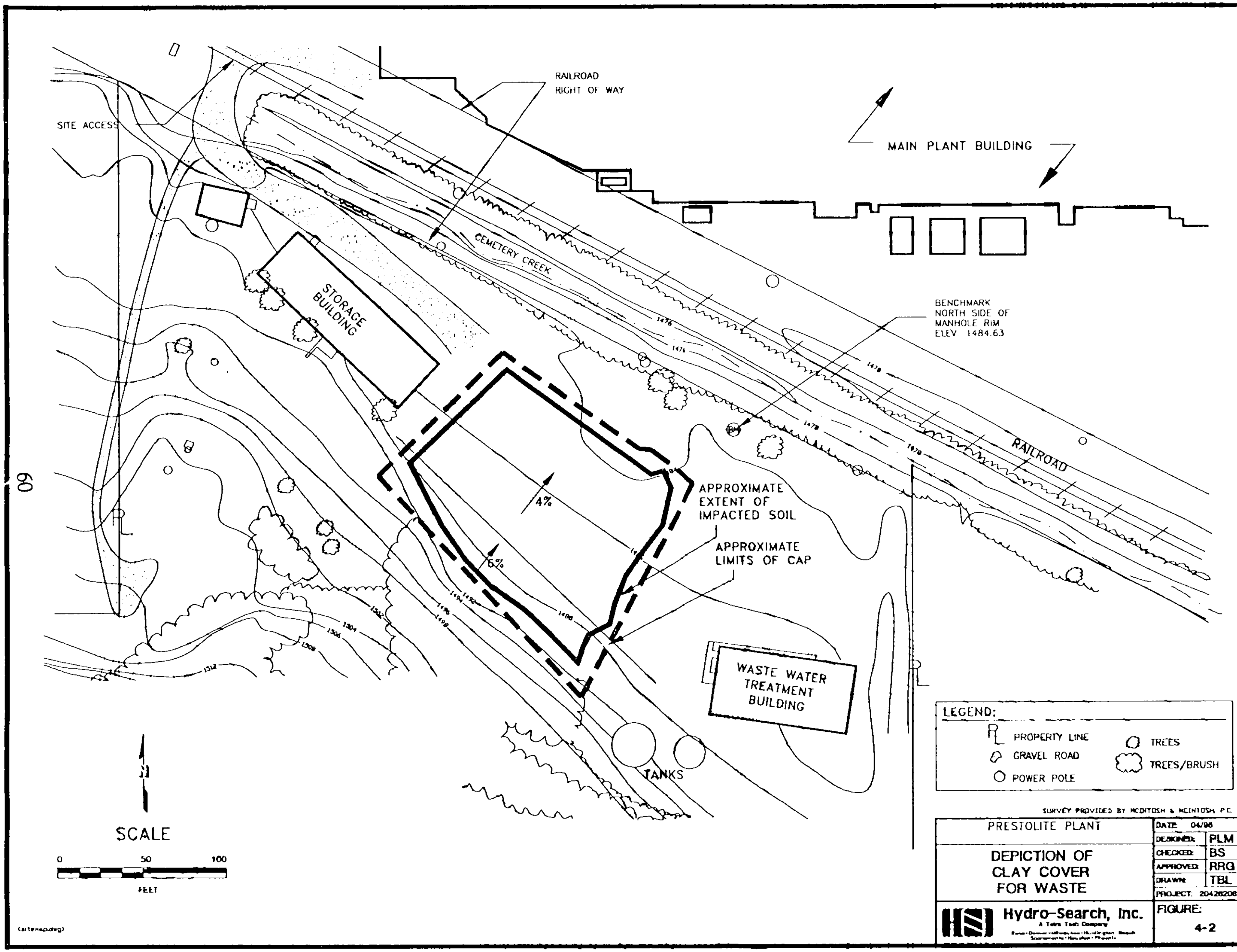
(2089\altd)

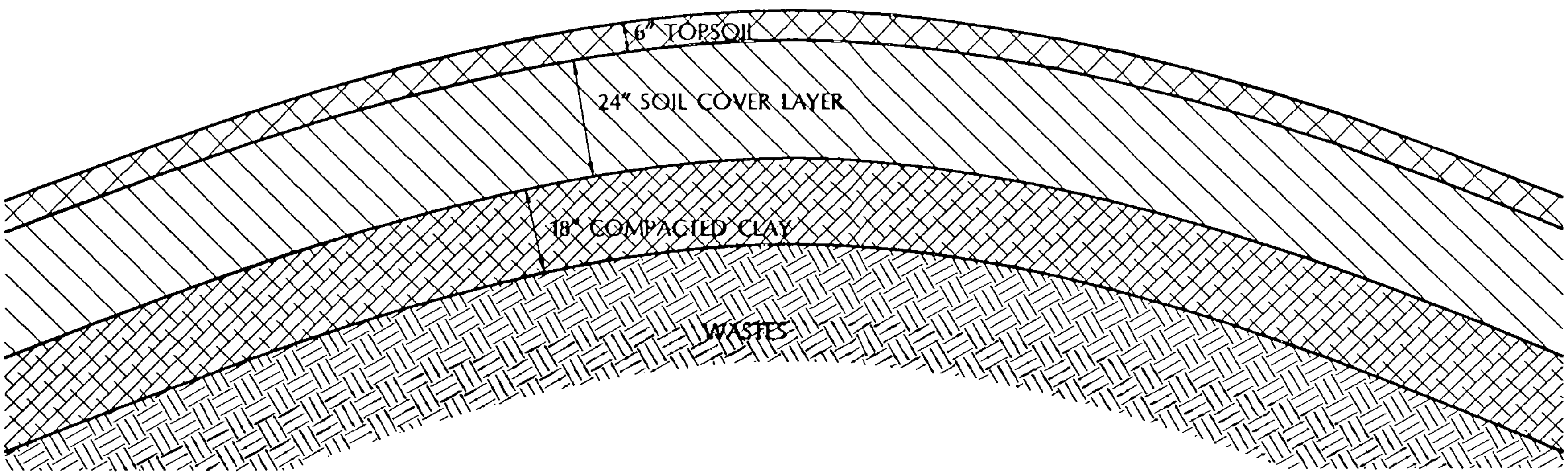
A suitable clay source is assumed to be available within 100 miles of the site. The clay would be topped with 24 inches of common borrow to protect the clay, and 6 inches of topsoil which would be revegetated. This alternative would require restrictions on the use of the property, along with maintenance and monitoring to ensure the integrity of the cap and the quality of the ground water. Figure 4-2 shows the assumed extent and grade of the cap and Figure 4-3 shows a cross section of the cover.

Four existing wells in close proximity to and downgradient of the cap are assumed sufficient to monitor ground water. Semi-annual monitoring of these wells for inorganics and VOCs is assumed. Costs are shown on Table 4-5.

4.2.5 Alternative G: Excavation and Off-Site Disposal

Under this alternative the entire affected area would be excavated for disposal at an off-site facility. As noted for Alternative D, this excavation will require some controls to minimize and monitor VOC emissions. Since the soils are a RCRA characteristic hazardous waste (because of leachable cadmium), the waste must be treated to meet Universal Treatment Standards in order to be acceptable for disposal. Leachable cadmium would be stabilized on-site by mixing excavated soils with a stabilizing agent. Depending on VOC concentrations after stabilization of metals, it is possible that some of the soils will require additional off-site treatment to destroy VOCs and disposal at a Subtitle D facility. Costs shown in Table 4-6 assume that 25 percent of the soils can be disposed at a Subtitle C facility, 25 percent will require Subtitle D disposal and 50 percent will require incineration. These costs are highly dependent on site conditions and would be as low as $1,231,222 if all soils meet requirements for Subtitle D disposal. Clean fill would be used to backfill the excavation and restore the site to its original condition.


RAILROAD
RIGHT OF WAY
SITE ACCESS
MAIN PLANT BUILDING
CEMETERY CREEK
STORAGE BUILDING
BENCHMARK
NORTH SIDE OF
MANHOLE RIM
ELEV. 1484.63
RAILROAD
4%
6%
APPROXIMATE
EXTENT OF
IMPACTED SOIL
APPROXIMATE
LIMITS OF CAP
WASTE WATER
TREATMENT
BUILDING
TANKS
LEGEND:
PROPERTY LINE
GRAVEL ROAD
POWER POLE
TREES
TREES/BRUSH
SCALE
0
50
100
FEET
N
SURVEY PROVIDED BY MCINTOSH & MCINTOSH, P.C.
PRESTOLITE PLANT
DEPICTION OF
CLAY COVER
FOR WASTE
DATE: 04/96
DESIGNED: PLM
CHECKED: BS
APPROVED: RRG
DRAWN: TBL
PROJECT: 204262069
Hydro-Search, Inc.
A Tetra Tech Company
FIGURE:
4-2



PRESTOLITE PLANT	DATE: 4/96	
COSS-SECTION OF TYPICAL LANDFILL CAP	DESIGNED:	CW
	CHECKED:	BW
	APPROVED:	BS
	DRAWN:	TBL
	PROJECT: 2069	
Hydro-Search, Inc. A Tetra Tech Company	FIGURE: 4-3	

TABLE 4-5
ESTIMATED COSTS FOR ALTERNATIVE F: CAPPING

UPFRONT COSTS		
Mob./Demob.	$3,000	Engineers Estimate
Site Preparation and Grading	1,200	From Means
Clay Layer	13,100	From Means
Barrier Layer	13,000	From Means
Topsoil	3,000	From Means
Revegetation	600	From Means
Surveying	2,000	Engineers Estimate
Health and Safety	3,590	10% of DC
Direct Costs	**$39,490**	
Bonds	1,185	3% of DC
Engineering	12,000	Engineers Estimate
Documentation (CQA, CCR and Monitoring Pl	15,000	Engineers Estimate
Construction Oversight	6,100	Engineers Estimate
QA Testing	2,500	Engineers Estimate
Contingency	7,898	20% of DC
TOTAL UPFRONT COST	**$84,173**	
OPERATION AND MAINTENENCE COSTS		
Annual Inspection	$1,000	Engineers Estimate
Mowing	250	5 mowings @ $50
Maintenance	1,975	5% of DC
GW Monitoring	4,000	Semiannual, $2,000/event
Administration	5,000	
TOTAL ANNUAL O&M	**$12,225**	
Project Life: 30 years		
O&M Present Worth:	$187,921	5% return
TOTAL PROJECT PRESENT WORTH	**$272,094**	

(2089\altf)

TABLE 4-6

ESTIMATED COSTS FOR ALTERNATIVE G: OFF-SITE DISPOSAL

UPFRONT COSTS

Stabilization (Metals Only)

Site Work		
Site Preparation	$1,000	From Means
Excavation	29,000	$5/cu yard
Treatment		
Mob./Demob.	50,000	Vendor Quote
Stabilization	483,503	Vendor Quote $65/ton
Other		
Health and Safety	30,720	5% of DC
Air Monitoring	6,000	$2,000/month
Backfill/Revegetation	29,000	$5/cu yard, From Means
Confirmation Sampling	7,500	100 soil @ $75/each
	8,400	70 TCLP @ $120/each
Direct Costs (Stabilization)	**$645,123**	

Disposal Costs

Transport and Disposal	$83,683	Vendor Quote, $45/ton, 25% of Waste to Subtitle D
Transport and Disposal	446,310	Vendor Quote, $240/ton, 25% of Waste Subtitle C
Transport and Disposal	6,694,650	Vendor Quote, $1,800/ton, 50% of waste incinerated
Disposal Costs	**$7,224,643**	

Bonds	$236,093	3% of DC
Engineering	8,000	Engineers Estimate
Documentation (O&M and Monitoring Plan	12,000	Engineers Estimate
Construction Oversight	6,000	Engineers Estimate
Contingency	1,573,953	20% of DC
TOTAL UPFRONT COST	**$9,705,812**	

Note: Disposal costs are highly dependent on stabilized waste characteristics i.e., if all wastes can be disposed at a Subtitle C facility, the total capital cost is approximately $1,231,200.

(2089\altg)

5.0 DETAILED ANALYSIS OF ALTERNATIVES

NYS Guidance recommends that when assessing alternatives for site remediation, seven criteria need to be considered. Each alternative is evaluated with respect to these criteria.

5.1 Evaluation Criteria

In order to conduct a comprehensive, comparative analysis of the remedial alternatives, each of the remedial alternatives is assessed against the evaluation criteria that has been developed in NYS guidance. These seven criteria are:

1. Overall protection of human health and the environment,
2. Compliance with SCGs,
3. Long-term effectiveness and permanence,
4. Reduction of toxicity, mobility, or volume,
5. Short-term effectiveness,
6. Implementability, and
7. Cost.

During the detailed analysis, each alternative is objectively assessed against each of the seven criteria and then scored in accordance with NYS guidelines. A brief discussion of each of the seven evaluation criteria is provided below.

5.1.1 Overall Protection of Human Health and the Environment

This criterion assesses whether an alternative adequately protects human health and the environment. This criterion assesses to what degree an alternative would eliminate, reduce or control the risks to human health and the environment associated with the site, through treatment, engineering, or institutional controls. It is an overall assessment of protection that encompasses an assessment of the other criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with SCGs.

5.1.2 Compliance with SCGs

This criterion assesses whether a remedial alternative meets NYS standards, criteria, or guidelines which apply to the particular action, media or location. All identified chemical-specific, location-specific, and action-specific SCGs should be considered in making this assessment. Section 2.0 identifies the SCGs which are considered potentially applicable to this site and remediation.

5.1.3 Long-Term Effectiveness and Permanence

This criterion assesses whether a remedial alternative would carry a potential, continual risk to human health and the environment after the remedial action is completed. An evaluation is made as to the magnitude of the residual risk present after the completion of the remedial actions as well as the adequacy and reliability of controls that could be implemented to monitor and manage the residual risk remaining.

5.1.4 Reduction of Toxicity, Mobility or Volume

This criterion assesses to what degree a remedial alternative reduces the quantity and exposure to hazardous materials that could pose a threat. The preferred method to accomplish this is through irreversible treatment of the waste material.

5.1.5 Short-Term Effectiveness

This criterion assesses the degree to which human health and the environment would be impacted during the implementation of the remedial alternative. The protection of workers, the community, and the surrounding environment as well as the time to achieve the remedial response objectives are considered in making this assessment.

5.1.6 Implementability

This criterion assesses the technical and administrative feasibility of implementing a remedial alternative and the availability of services and materials required during implementation. The ability to construct and operate the technologies included as part of an alternative, the reliability of these technologies, the ability to comply with regulatory requirements, the relative ease of undertaking additional remedial action if required, and monitoring requirements are considered in assessing the technical and administrative feasibility of implementing an alternative. The availability of off-site treatment, storage capacity, disposal services, necessary equipment, and personnel are considered in assessing the availability of services and materials required for implementing a remedial alternative.

5.1.7 Costs

This criterion assesses the upfront costs, operation and maintenance costs, and total present worth analysis associated with implementing a remedial alternative. The upfront costs are divided into direct costs and indirect costs. Direct upfront costs include construction costs, equipment costs, and site development costs. Indirect upfront costs include engineering expenses, legal fees and license or permit costs, start-up costs and contingency allowances.

Operation and maintenance (O&M) costs are post-construction costs necessary to ensure the continued effectiveness of a remedial action. These costs include operating labor costs, labor and materials associated with maintenance, any ongoing raw materials requirements, and energy costs. These costs also include disposal of residues, administrative costs, insurance and licensing costs, demobilization costs, and costs of periodic site reviews, if required.

The cost estimates presented in this report were developed utilizing several sources, including: Means Cost Data (Means, 1989-1994); quotations from vendors on specific equipment and material supplies; other published cost estimating guidance; and general information from projects of a similar nature. In accordance with standard practice and USEPA guidance, the estimated costs are expected to provide an accuracy of +50 to -30 percent.

In those cases where necessary, after development of the upfront and operation and maintenance costs, a present worth analysis of remedial action costs is conducted. A present worth analysis relates costs that occur over different time periods to present costs by discounting all future costs to the present value. This allows the cost of remedial alternatives to be compared on the basis of a single figure that represents the money required in today's dollars to construct, operate and maintain a particular remedial alternative throughout its planned life. For the purposes of this analysis, present worth costs were developed using a rate of return of 5 percent and a maximum duration of 30 years for the performance period of the remedial alternatives. While remedial activities under many of the alternatives will extend beyond this period, present worth costs will vary little with the extended duration.

5.1.8 Summary of Alternative Evaluation

Each alternative has been evaluated with respect to the above criteria. A summary of these evaluations is provided on Table 5-1.

5.2 Scoring of Alternatives

5.2.1 Alternative A: In-Situ SVE and Ex-Situ Stabilization

This alternative provides for the removal of the organics and immobilization of the inorganics (which remain on-site), and replacing the treated soil in the excavation. This will provide a permanent, reliable remedy which protects public health and the environment and should meet NYS standards for ground water protection. The extent of compliance monitoring for the SVE system, the excavation, and the stabilization process must be agreed upon with NYSDEC, as will be necessary with all the remedies. Dust control will be needed to mitigate potential inorganic exposure during excavation but is easily accomplished by wetting the soils. Organics will be

TABLE 5-1

DETAILED ANALYSIS OF ALTERNATIVES

Criteria	Alternative A In-Situ SVE and Ex-Situ Solidification	Alternative B In-Situ SVE and Ex-Situ Soil Washing	Alternative D Ex-Situ Thermal Desorption and Solidification	Alternative F Capping	Alternative G Off-Site Disposal
Overall Protection of Human Health and the Environment	• Removes organics and prevents direct exposure to inorganics • Reduces or eliminates mobility of constituents to groundwater and surface water • Low residual risk from solidified material	• Removes both organics and inorganics and eliminates all pathways for exposure from soil • Very low residual risk	• Removes organics and prevents direct exposure to inorganics • Reduces or eliminates mobility of constituents to groundwater and surface water • Low residual risk from solidified material	• Prevents contact with contaminated soils • Reduces leaching to ground water • Controls surface water migration • Some residual risk because all waste left in place	• Removes both organics and inorganics and eliminates all pathways for exposure from soil • Very low residual risk
Compliance with SCGs	• Capable of meeting chemical specific SCGs for organics • Will meet leaching goals through solidification • Meets all other location and action specific SCGs	• Capable of meeting all chemical specific SCGs for organics and inorganics • Meets all other location and action specific SCGs	• Capable of meeting chemical specific SCGs for organics • Will meet leaching goals through solidification • Meets all other location and action specific SCGs	• Cap conforms to NYS standards • Meets all other location and action specific SCGs	• Capable of meeting all chemical specific SCGs for organics and inorganics • Meets all other location and action specific SCGs
Long-Term Effectiveness and Permanence	• Actions provide a long term reliable solution to reducing potential exposure • No off-site residual is anticipated • No continued monitoring is needed	• Actions provide a long term reliable solution to reducing potential exposure • Landfilling of inorganic residuals is planned after meeting LDRs • No continued monitoring is needed	• Actions provide a long term reliable solution to reducing potential exposure • Incineration of organic residuals is planned • No continued monitoring is needed	• Cap provides reasonable assurance that exposure is reduced, however some leaching may occur and overall reliability of cap is dependent on proper and continued maintenance • Continual monitoring of ground water is required	• Actions provide a long term reliable solution to reducing potential exposure • Landfilling of residuals is planned after meeting LDRs • No continued monitoring is needed

Note: Alternative C and E were eliminated from consideration.

TABLE 5-1 (Continued)

DETAILED ANALYSIS OF ALTERNATIVES

Criteria	Alternative A In-Situ SVE and Ex-Situ Solidification	Alternative B In-Situ SVE and Ex-Situ Soil Washing	Alternative D Ex-Situ Thermal Desorption and Solidification	Alternative F Capping	Alternative G Off-Site Disposal
Reduction of Toxicity, Mobility, or Volume	• Organics are removed and destroyed in atmosphere • Inorganics are immobilized • Both are irreversible	• Organics are removed and destroyed in atmosphere • Inorganics are removed and safely disposed • Both are irreversible	• Organics are removed and destroyed • Inorganics are immobilized • Both are irreversible	• Cap reduces mobility but not toxicity or volume	• Does not reduce volume but reduces toxicity and mobility
Short-Term Effectiveness	• Excavation will create dust with inorganics but can easily be controlled • Remedy requires 15 months	• Excavation will create dust with inorganics but can easily be controlled • Remedy requires 15 months	• Excavation of soils may release VOCs to atmosphere temporarily exposing workers and nearby population • Remedy requires 6 months	• Excavation will create dust with inorganics but can easily be controlled • Construction requires 2 months • Remedy must be maintained in perpetuity	• Excavation and treatment of soils may release VOCs to atmosphere temporarily exposing workers and nearby population • Remedy requires 2 months
Implementability	• Technologies are proven and equipment is readily available • Air permit may be required • Disposal is straightforward • Monitoring scheme for SVE and applicable standards must be negotiated with agency	• SVE technology is proven and available • Soil washing is not widely used and requires specialized skills and equipment but appears effective and is available from several vendors • Some pre-testing is likely to be required • Air permit may be required • Disposal will require some action to meet LDRs	• Thermal desorption is proven and available from several vendors, although it is a rather complex process, requiring specialized vendors and equipment • Solidification is a proven and available technology • Some pre-testing is likely to be required • An air permit may be required • A water source may be necessary	• Capping of this type is commonly done • A clay and borrow source in the vicinity of the site must be identified • Monitoring requirements must be negotiated with the agency	• Excavation, treatment and disposal are available • Some difficulty may be encountered in finding facilities to treat to LDRs for disposal • Soil washing is not widely used and requires specialized skills and equipment but appears effective and is available from several vendors

Note: Alternative C and E were eliminated from consideration.

TABLE 5-1 (Continued)

DETAILED ANALYSIS OF ALTERNATIVES

Criteria	Alternative A In-Situ SVE and Ex-Situ Solidification	Alternative B In-Situ SVE and Ex-Situ Soil Washing	Alternative D Ex-Situ Thermal Desorption and Solidification	Alternative F Capping	Alternative G Off-Site Disposal
Implementability (continued)		• Monitoring scheme for SVE of applicable standards must be negotiated with agency • A water source and some water treatment and disposal may be necessary			• Some pre-testing is likely to be required • Air permit may be required • Disposal will require some action to meet LDRs • Monitoring scheme for SVE of applicable standards must be negotiated with agency • A water source and some water treatment and disposal may be necessary
Cost	$ 1,068,111	$ 2,794,585	$ 2,066,148	$ 272,094	$ 9,705,812

Note: Alternative C and E were eliminated from consideration.

dispersed to decay in the atmosphere thus reducing the toxicity and volume of these contaminants. Inorganics will be irreversibly bound in the soils, reducing the mobility and toxicity of these contaminants. The technologies are proven, easily implemented, and very reliable. The remedy requires approximately 15 months to complete and air permitting may be necessary for the SVE system. Some off-site disposal of material treated on-site is necessary but is minimized. Costs for this remedy are judged moderate. This alternative scored a total of 83 using NYS analysis procedures documented in Appendix G.

5.2.2 Alternative B: In-Situ SVE and Ex-Situ Soil Washing

This alternative provides for the removal of the organics and inorganics from the impacted soil mass, replacing treated soil in the excavation, and disposal of the residual contaminated soil at a permitted landfill. This will result in a permanent and reliable remedy which will protect public health and the environment and meet NYS standards. The technology for SVE is proven and easily implemented. Although soil washing is somewhat experimental, several vendors provide transportable systems and the technology is proven for removal of inorganics from soils which have a particle size distribution amenable to the technology. At this site, the particle size distribution is less than ideal and results in a relatively large percentage of fines which would require off-site disposal. Pilot tests would be necessary. Easily implemented dust controls would be needed to mitigate impacts during excavation. As noted for Alternative A, some negotiation will be necessary to determine verification sampling procedures and methodologies. The remedy is permanent and does not restrict future land use. It is likely that a water source would be necessary to provide make-up water to the system and some post-treatment water conditioning and disposal may be necessary. The remedy requires 15 months to complete and air permitting may be necessary for the SVE system. Off-site disposal will be necessary for as much as 50% of the soil mass. Costs for this remedy are high due to the high unit costs for both soil washing and for off-site disposal. This alternative scored a total of 73 using NYS procedures documented in Appendix G.

5.2.3 Alternative D: Ex-Situ Thermal Desorption and Stabilization

This alternative provides for the removal of the organics and immobilization of the inorganics (which remain on-site), and replacing the treated soil in the excavation. This will result in a permanent and reliable remedy which will protect public health and the environment. The technologies required are proven, easily implemented, and several vendors offer transportable units. The units are rather complex to set-up and operate but sufficient operating experience shows that they are capable of treating organics effectively and reliably. A pilot test will likely be required to verify operating parameters and potential air emissions. During initial excavation activities, dust and VOCs will be produced and measures must be taken to minimize worker exposure and contaminant migration from the site. No restrictions on landuse will be necessary. The organic residue produced by the thermal unit will be sent off-site for incineration at a permitted facility. Inorganics will be irreversibly bound in the soils, reducing the mobility and toxicity of these contaminants. Several vendors provide portable thermal desorption systems and are capable of conducting pilot tests. Short term impacts could include the release of VOCs during excavation activities. The remedy will provide a permanent fix for the contamination which does not restrict future land use. The remedy does require six months to complete and air permitting may be necessary for the thermal desorption system. Some off-site disposal of material stabilized on-site will be necessary but is minimized. Costs for this remedy are relatively high due to the high unit costs for thermal desorption. This alternative scored a total of 76 using NYS analysis procedures documented in Appendix G.

5.2.4 Alternative F: Capping

The cap will prevent direct contact with the contaminated soils and reduce leaching into the ground water as well as controlling potential runoff into Cemetery Creek. The technology is proven and if maintained properly should provide a reasonable degree of protection to human health and the environment. The ultimate effectiveness of the cap in maintaining ground water standards is difficult to predict because movement of contaminants through the vadose zone is difficult to predict. Thus, compliance with NYS guidance for ground water can only be verified through monitoring.

The landfill cap design complies with NYS SCGs. Because contaminated soils will not be treated, neither toxicity nor volume will be reduced as a result of capping. The potential mobility of contaminants will be reduced by reducing the amount of precipitation which can percolate through the soils. The cap can be implemented in a relatively short period of time requiring only several months of construction. There are no short-term risks to the environment as a result of construction activities. Costs for this alternative are low. However, because of the need for long-term maintenance and monitoring along with land use restrictions, this alternative scores only a 61 using NYS procedures documented in Appendix G.

5.2.5 Alternative G: Off-Site Disposal

This alternative removes organic and inorganic contaminants completely from the site, thereby eliminating exposure pathways. Since contaminated soils are removed, all SCGs are met by excavation confirmation sampling. This action provides a reliable long-term solution to potential exposure since materials are removed. The volume of contaminated soils is not reduced, however, some form of treatment will be necessary to meet LDRs. While stabilization is applicable to meet inorganic requirements, the presence of organics in the soil may complicate the disposal options. No land use restrictions will remain on the property. Bulking during excavation and stabilization with Portland cement will increase volume by 10 to 15 percent and mass by 15 to 20 percent, thereby increasing disposal costs.

During excavation, dust and VOC's will be produced and measures must be taken to minimize worker exposure and contaminant migration from the site. This remedy is estimated to require about two months to complete. The technology for this option is readily available. Excavation and stabilization of inorganics has been conducted at this site. Disposal at a Subtitle C facility is assumed. Costs for this alternative are high. This alternative scores a 69 using NYS procedures documented in Appendix G.

5.3 Comparison of Alternatives and Recommendations

All the alternatives developed and analyzed in detail provide adequate protection of health and the environment, meet NYS SCGs and provide for long-term protection. The capping alternative (F) which leaves all the untreated soil on-site is the one option of these 5 which has a relatively high degree of uncertainty with regard to its ultimate effectiveness. This results from uncertainties related to the transport of materials from untreated soil to the ground water and the uncertainties associated with the maintenance of the cap over long periods of time.

Alternatives A, B, and D all provide a maximum reduction of toxicity, mobility and volume of the waste. Alternative G does provide a substantial reduction in toxicity and mobility through off-site disposal. Alternative F provides a reduction in mobility only through capping.

All the alternatives have some short-term impact from contaminated dust production, however, this is easily mitigated and is not expected to cause any difficulties. Alternatives D and G have the further potential impact of releasing VOCs during excavation activities. For these two alternatives, some changes in the excavation procedures may be necessary to minimize volatilization. Additionally, increased monitoring will be necessary to avoid off-site impacts and to protect workers. Alternatives D and G will require specialized soils transport to a disposal site, but transport is readily available. Alternatives D, F and G can all be implemented in a span of several months. Alternatives A and B would require approximately 15 months to complete.

Alternatives A and F use the most proven and easily implementable technologies. Alternatives B and D utilize more complex technologies that do not have widespread proven histories of full-scale use. Nevertheless, both alternatives are considered sufficiently reliable for use at this site. Alternative G also should be readily implementable, however, some difficulty may be encountered in disposing of the soils due to potential LDR restrictions on the organic contaminants.

Costs for the various options differ considerably. The lowest cost option is capping (Alternative F), at about $270,000. Costs for In-Situ SVE/Ex-Situ Stabilization (Alternative A) follow at approximately $1.1 million. Alternatives D and B (Thermal Desorption/Stabilization and Soil Vapor Extraction/Soil Washing) are priced at approximately $2.1 and $2.8 million, respectively. Alternative G, Off-Site Disposal is the most expensive at an estimated $9.2 million.

Finally, technologies or combinations of technologies appropriate for remediation of the VOC and metals impacted soils at this site are summarized using the NYS scoring procedure on Table 5-2. The alternatives are listed below with their NYS score totals, in order of declining preference:

1) Alternative A: In-Situ SVE/Ex-Situ Stabilization (83 points)
2) Alternative D: Ex-Situ Thermal Desorption/Stabilization (76 points)
3) Alternative B: In-Situ SVE/Ex-Situ Soil Washing (73 points)
4) Alternative G: Off-Site Disposal (72 points)
5) Alternative F: Capping (61 points)

Based on the NYS scoring procedure, costs, site experience and anticipated overall effectiveness of the technologies considered, Alternative A is recommended for use at the Prestolite site.

TABLE 5-2

REMEDIAL ALTERNATIVE SCORING SHEET SUMMARIES

	Alternative A: In-Situ SVE/ Ex-Situ Stabilization	**Alternative D: Ex-Situ Thermal Desorption/ Stabilization**	**Alternative B: In-Situ SVE/ Ex-Situ Soil Washing**	**Alternative G: Off-Site Disposal**	**Alternative F: Capping**
Compliance with NYS Standards and SCGs (Maximum Score: 10)	10	10	10	10	10
Protection of Human Health and the Environment (Maximum Score: 20)	20	20	20	20	20
Short Term Effectiveness (Maximum Score: 10)	10	9	10	9	10
Long Term Effectiveness and Permanence (Maximum Score: 15)	15	15	15	12	6
Reduction of Toxicity, Mobility or Volume (Maximum Score: 15)	14	11	7	7	2
Implementability (Maximum Score: 15)	14	11	11	14	13
Total	**83**	**76**	**73**	**72**	**61**

6.0 REFERENCES

Hydro-Search, Inc. April 28,1992a. Phase II Site Investigation, Prestolite Plant, Arcade, New Yori. HSI Project No. 426116372.

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IT Corporation, 1991. Phase I Site Investigation.

Johnson, Kemblowski, Colthort, Byers, and Stanley, 1990. A Practical Approach to the Design, Operation, and Monitoring of In-Situ Soil Venting Systems. Ground Water Monitoring Review (10) pgs. 159-178.

Means, 1994. Means Site Work Cost Data, 12th Annual Edition. R.S. Means Company, Inc., Kingston, MA.

New York State Department of Environmental Conservation, May 15, 1990. Revised Technical and Administrative Guidance Memorandum: Selection of Remedial Actions at Inactive Hazardous Waste Sites.

New York State Department of Environmental Conservation, January 24, 1994. Division Technical and Administrative Guidance Memorandum: Determination of Soil Cleanup Objectives and Cleanup Levels.

Nyer, E.K., 1993. Practical Techniques for Ground Water and Soil Remediation. Lewis Publishers.

U.S. EPA, 1988. Functional Guidelines for Data Validation of Organic Analyses.

APPENDIX A

LABORATORY REPORT FOR VOC IMPACTED SOIL SAMPLES

SAMPLE DATA SUMMARY PACKAGE

RECRA
ENVIRONMENTAL
INC.

CASE NARRATIVE

Laboratory Name: Recra Environmental, Inc.

Laboratory Code: RECNY

Case Number: 5281

Sample Identification: V2-175N,80E
V3-175N,80E
V3-175N,80E Matrix Spike

METHODOLOGY

"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods" (SW-846), Third Edition, August 1993, U.S. Environmental Protection Agency Office of Solid Waste.

COMMENTS

The enclosed data has been reported utilizing data qualifiers (Q) as defined on the Organic and Inorganic Data Comment Pages.

Soil sample results have been corrected for percent solids and are reported on a dry weight basis.

VOLATILE DATA

Volatile sample and standard areas are listed on the corresponding data system printouts.

Volatile data was processed utilizing Finnigan DataPro Autoquantitation and Recra Environmental's Inc.'s Analytical Information Management System (AIMS). All compounds determined to be present by the computer-generated auto quantitation were subjected to a manual ion search for secondary and tertiary ions. If spectral identification criteria were not met, those compounds were deleted from the quantitation report.

Sample V2-175N,80E required a dilution due to high concentrations of Ethyl benzene and Total Xylenes, and was re-analyzed with sample weight 1.23 grams.

METALS DATA

Sample identifications have been abbreviated due to the character limitations of the software.

"I certify that this data package is in compliance with the terms and conditions of the contract both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or his designee, as verified by the following signature."

Kenneth E. Kasperek
~~Laboratory~~ Director

3/2/95
Date

ORGANIC DATA COMMENT PAGE

Laboratory Name: Recra Environmental, Inc.

USEPA Defined Organic Data Qualifiers:

U - Indicates compound was analyzed for but not detected.

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

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

B - This flag is used when the analyte is found in the associated blank as well as in the sample.

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

D - This flag identifies all compounds identified in an analysis at a secondary dilution factor.

G - The TCLP Matrix Spike recovery was greater than the upper limit of the analytical method.

L - The TCLP Matrix Spike recovery was lower than the lower limit of the analytical method.

T - This flag is used when the analyte is found in the associated TCLP extraction as well as in the sample.

N - Indicates presumptive evidence of a compound. This flag is only used for tentatively identified compounds, where the identification is based on a mass spectral library search. It is applied to all TIC results.

P - This flag is used for a pesticide/Aroclor target analyte when there is greater than 25% difference for detected concentrations between the two GC columns. The lower of the two values is reported on the Form I and flagged with a "P".

A - This flag indicates that a TIC is a suspected aldol-condensation product.

INORGANIC DATA COMMENT PAGE

Laboratory Name: Recra Environmental, Inc.

USEPA Defined Inorganic Data Qualifiers:

B	-	Indicates a value greater than or equal to the instrument detection limit, but less than the contract required detection limit.
U	-	Indicates element was analyzed for but not detected. Report with the detection limit value (e.g., 100).
E	-	Indicates a value estimated or not reported due to the presence of interference.
S	-	Indicates value determined by Method of Standard Addition.
N	-	Indicates spike sample recovery is not within control limits.
*	-	Indicates duplicate analysis is not within control limits.
+	-	Indicates the correlation coefficient for Method of Standard Addition is less than 0.995.
M	-	Indicates duplicate injection results exceeded control limits.
W	-	Post digestion spike for Furnace AA analysis is out of control limits (85-115%), while sample absorbance is less than 50% of spike absorbance.

HYDRO SEARCH
METHOD 8240 - TCL VOLATILE ORGANICS
ANALYSIS DATA SHEET

0006
Client No.

V2-175N,80E

Lab Name: Recra Environmental Contract: ____________

Lab Code: RECNY Case No.: ______ SAS No.: ______ SDG No.: ______

Matrix: (soil/water) SOIL Lab Sample ID: A5086401

Sample wt/vol: 5.04 (g/mL) G Lab File ID: G2060.MSO

Level: (low/med) LOW Date Samp/Recv: 02/14/95 02/14/95

% Moisture: not dec. 14.0 Heated Purge: Y Date Analyzed: 02/15/95

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: ______ (uL) Soil Aliquot Volume: ______ (uL)

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG

CAS NO.	COMPOUND	UG/KG	Q
67-64-1	Acetone	10	U
71-43-2	Benzene	5	U
75-27-4	Bromodichloromethane	5	U
75-25-2	Bromoform	5	U
74-83-9	Bromomethane	10	U
78-93-3	2-Butanone	10	U
75-15-0	Carbon Disulfide	5	U
56-23-5	Carbon Tetrachloride	5	U
108-90-7	Chlorobenzene	5	U
75-00-3	Chloroethane	10	U
67-66-3	Chloroform	5	U
74-87-3	Chloromethane	10	U
124-48-1	Dibromochloromethane	5	U
75-34-3	1,1-Dichloroethane	5	U
107-06-2	1,2-Dichloroethane	5	U
75-35-4	1,1-Dichloroethene	5	U
540-59-0	1,2-Dichloroethene (Total)	19	
78-87-5	1,2-Dichloropropane	5	U
10061-01-5	cis-1,3-Dichloropropene	5	U
10061-02-6	trans-1,3-Dichloropropene	5	U
100-41-4	Ethyl benzene	520	E
591-78-6	2-Hexanone	10	U
75-09-2	Methylene chloride	5	U
108-10-1	4-Methyl-2-pentanone	10	U
100-42-5	Styrene	5	U
79-34-5	1,1,2,2-Tetrachloroethane	5	U
127-18-4	Tetrachloroethene	6	
108-88-3	Toluene	47	B
71-55-6	1,1,1-Trichloroethane	5	U
79-00-5	1,1,2-Trichloroethane	5	U
79-01-6	Trichloroethene	2	BJ
108-05-4	Vinyl acetate	10	U
75-01-4	Vinyl chloride	10	U
1330-20-7	Total Xylenes	2600	E

METHOD 8240 - TCL VOLATILE ORGANICS
ANALYSIS DATA SHEET

Client No.: V2-175N,80E DL

Lab Name: Recra Environmental Contract: ________

Lab Code: RECNY Case No.: ______ SAS No.: ______ SDG No.: ______

Matrix: (soil/water) SOIL Lab Sample ID: A5086401DL

Sample wt/vol: 1.23 (g/mL) G Lab File ID: G2065.MSO

Level: (low/med) LOW Date Samp/Recv: 02/14/95 02/14/95

% Moisture: not dec. 14.0 Heated Purge: Y Date Analyzed: 02/15/95

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: ______ (uL) Soil Aliquot Volume: ______ (uL)

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG

CAS NO.	COMPOUND	UG/KG	Q
67-64-1	Acetone	24	U
71-43-2	Benzene	5	U
75-27-4	Bromodichloromethane	5	U
75-25-2	Bromoform	5	U
74-83-9	Bromomethane	10	U
78-93-3	2-Butanone	24	U
75-15-0	Carbon Disulfide	5	U
56-23-5	Carbon Tetrachloride	5	U
108-90-7	Chlorobenzene	5	U
75-00-3	Chloroethane	10	U
67-66-3	Chloroform	5	U
74-87-3	Chloromethane	10	U
124-48-1	Dibromochloromethane	5	U
75-34-3	1,1-Dichloroethane	5	U
107-06-2	1,2-Dichloroethane	5	U
75-35-4	1,1-Dichloroethene	5	U
540-59-0	1,2-Dichloroethene (Total)	9	D
78-87-5	1,2-Dichloropropane	5	U
10061-01-5	cis-1,3-Dichloropropene	5	U
10061-02-6	trans-1,3-Dichloropropene	5	U
100-41-4	Ethyl benzene	570	D
591-78-6	2-Hexanone	24	U
75-09-2	Methylene chloride	5	U
108-10-1	4-Methyl-2-pentanone	19	U
100-42-5	Styrene	5	U
79-34-5	1,1,2,2-Tetrachloroethane	5	U
127-18-4	Tetrachloroethene	4	DJ
108-88-3	Toluene	41	BD
71-55-6	1,1,1-Trichloroethane	5	U
79-00-5	1,1,2-Trichloroethane	5	U
79-01-6	Trichloroethene	5	U
108-05-4	Vinyl acetate	10	U
75-01-4	Vinyl chloride	10	U
1330-20-7	Total Xylenes	2700	D

HYDRO SEARCH
METHOD 8240 - TCLP VOLATILES
ANALYSIS DATA SHEET

Client No.

V3-175N,80E

Lab Name: Recra Environmental   Contract: ______

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

Matrix: (soil/water) SOIL   Lab Sample ID: A5086402

Sample wt/vol: 5.00 (g/mL) ML   Lab File ID: L4725.RR

Level: (low/med) LOW   Date Samp/Recv: 02/14/95 02/14/95

% Moisture: not dec. 100.0   Heated Purge: N   Date Analyzed: 02/17/95

GC Column: DB-624   ID: 0.53 (mm)   Dilution Factor: 1.00

Soil Extract Volume: ____ (uL)   Soil Aliquot Volume: ____ (uL)

CONCENTRATION UNITS: (ug/L or ug/Kg) MG/L

CAS NO.	COMPOUND	MG/L	Q
71-43-2	Benzene	0.0050	U
78-93-3	2-Butanone	0.010	U
56-23-5	Carbon Tetrachloride	0.0050	U
108-90-7	Chlorobenzene	0.0050	U
67-66-3	Chloroform	0.0050	U
107-06-2	1,2-Dichloroethane	0.0050	U
75-35-4	1,1-Dichloroethene	0.0050	U
127-18-4	Tetrachloroethene	0.0050	U
79-01-6	Trichloroethene	0.0050	U
75-01-4	Vinyl chloride	0.010	U

HYDRO-SEARCH

COVER PAGE - INORGANIC ANALYSES DATA PACKAGE

Lab Name: RECRA_ENVIRONMENTAL_INC._ Contract: NY95-143__

Lab Code: RECNY_ Case No.: 5281_ SAS No.: ______ SDG No.:0864__

SOW No.: SW846 3RD.ED.

Sample No.	Lab Sample ID
V2-175N	4313
V2-175ND	4314
V2-175NS	4315
V3-175N	4445
V3-175NS	4446

Were ICP interelement corrections applied ? Yes/No YES

Were ICP background corrections applied ? Yes/No YES
If yes - were raw data generated before application of background corrections ? Yes/No NO_

Comments:

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Signature: K E Kasperek Name: KENNETH E. KASPEREK

Date: 3/2/95 Title: LABORATORY DIRECTOR

HYDRO-SEARCH

1
INORGANIC ANALYSES DATA SHEET

SAMPLE NO.

V2-175N

Lab Name: RECRA_ENVIRONMENTAL_INC._ Contract: NY95-143__

Lab Code: RECNY_ Case No.: 5281__ SAS No.: ______ SDG No.: 0864__

Matrix (soil/water): SOIL_ Lab Sample ID: 4313

Level (low/med): LOW__ Date Received: 02/14/95

% 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	98.8			P
7440-70-2	Calcium				NR
7440-47-3	Chromium	160		N*	P
7440-48-4	Cobalt				NR
7440-50-8	Copper				NR
7439-89-6	Iron				NR
7439-92-1	Lead	109		N*	P
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: BROWN____ Clarity Before: CLEAR_ Texture: MEDIUM

Color After: YELLOW___ Clarity After: CLEAR_ Artifacts: ______

Comments:
LAB_SAMPLE_ID:_A5086401-CGA00015
CLIENT_SAMPLE_ID:_V2-175N,80E

FORM I - IN

HYDRO-SEARCH

1
INORGANIC ANALYSES DATA SHEET

SAMPLE NO.

V3-175N

Lab Name: RECRA_ENVIRONMENTAL_INC._ Contract: NY95-143__

Lab Code: RECNY_ Case No.: 5281__ SAS No.: ______ SDG No.: 0864__

Matrix (soil/water): WATER Lab Sample ID: 4445

Level (low/med): LOW__ Date Received: 02/14/95

% 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_		_		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__	2260	_		P_
7440-70-2	Calcium__		_		NR
7440-47-3	Chromium_	10.0	U		P_
7440-48-4	Cobalt___		_		NR
7440-50-8	Copper___		_		NR
7439-89-6	Iron_____		_		NR
7439-92-1	Lead_____	723	_		P_
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: COLORLESS Clarity Before: CLEAR_ Texture: ______

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: ______

Comments:
LAB_SAMPLE_ID:_A5086402_-_CGA00014
CLIENT_SAMPLE_ID:_V3-175N,80E
TCLP_EXTRACT

FORM I - IN

HYDRO SEARCH
METHOD 8240 - TCL VOLATILE ORGANICS
SOIL SURROGATE RECOVERY

Lab Name: Recra Environmental   Contract: ________

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

Level (low/med): LOW

	Client Sample ID	TOL %REC #	BFB %REC #	DCE %REC #						TOT OUT
1	V2-175N,80E	100	104	99						0
2	V2-175N,80E DL	93	108	98						0
3	VBLK 63	97	106	95						0

		QC LIMITS
TOL	= Toluene-D8	(81-117)
BFB	= p-Bromofluorobenzene	(74-121)
DCE	= 1,2-Dichloroethane-D4	(70-121)

\# Column to be used to flag recovery values
* Values outside of contract required QC limits
D Surrogates diluted out

HYDRO SEARCH
METHOD 8240 - TCLP VOLATILES
SOIL SURROGATE RECOVERY

Lab Name: Recra Environmental Contract: ____________

Lab Code: RECNY Case No.: _____ SAS No.: ______ SDG No.: ______

Level (low/med): LOW

	Client Sample ID	TOL %REC #	BFB %REC #	DCE %REC #						TOT OUT
1	EXTRACTOR BLANK	100	95	106						0
2	MATRIX SPIKE BLANK	99	94	107						0
3	V3-175N,80E	96	92	104						0
4	V3-175N,80E MS	100	97	106						0
5	VBLK 74	100	100	107						0

		QC LIMITS
TOL	= Toluene-D8	(88-110)
BFB	= p-Bromofluorobenzene	(86-115)
DCE	= 1,2-Dichloroethane-D4	(76-114)

\# Column to be used to flag recovery values
* Values outside of contract required QC limits
D Surrogates diluted out

METHOD 8240 - TCLP VOLATILES
SOIL MATRIX SPIKE BLANK RECOVERY

Lab Name: Recra Environmental, Inc. Contract: ________ Lab Samp ID: A5086408

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

Matrix Spike - Client Sample No.: ~~VBLK-74~~ MSBLANK Level: (low/med) LOW

MTF 2/28/95

COMPOUND	SPIKE ADDED MG/L	MSB CONCENTRATION MG/L	MSB % REC #	QC LIMITS REC.
1,1-Dichloroethene	0.050	0.050	100	61 - 145
Trichloroethene	0.050	0.050	100	71 - 120
Benzene	0.050	0.056	112	76 - 127
Chlorobenzene	0.050	0.052	104	75 - 130

\# Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

Spike recovery: 0 out of 4 outside limits

Comments: ______________________________

HYDRO SEARCH
METHOD 8240 - TCLP VOLATILES
SOIL MATRIX SPIKE RECOVERY

Lab Name: Recra Environmental, Inc. Contract: ________ Lab Samp ID: A5086402

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

Matrix Spike - Client Sample No.: V3-175N,80E Level: (low/med) LOW

COMPOUND	SPIKE ADDED MG/L	SAMPLE CONCENTRATION MG/L	MS CONCENTRATION MG/L	MS % REC #	QC LIMITS REC.
Benzene	0.050	0	0.041	82	75 - 125
2-Butanone	0.050	0	0.046	92	75 - 125
Carbon Tetrachloride	0.050	0	0.039	78	75 - 125
Chlorobenzene	0.050	0	0.043	86	75 - 125
Chloroform	0.050	0	0.042	84	75 - 125
1,2-Dichloroethane	0.050	0	0.047	94	75 - 125
1,1-Dichloroethene	0.050	0	0.039	78	75 - 125
Tetrachloroethene	0.050	0	0.042	84	75 - 125
Trichloroethene	0.050	0	0.038	76	75 - 125
Vinyl chloride	0.050	0	0.046	92	75 - 125

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

Spike recovery: 0 out of 10 outside limits

Comments: ______________________________

6
DUPLICATES

SAMPLE NO.

V2-175ND

Lab Name: RECRA_ENVIRONMENTAL_INC._ Contract: NY95-143__

Lab Code: RECNY_ Case No.: 5281__ SAS No.: ______ SDG No.: 0864__

Matrix (soil/water): SOIL_ Level (low/med): _LOW__

% Solids for Sample: _86.0 % Solids for Duplicate: __86.0

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

Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	M
Aluminum								NR
Antimony								NR
Arsenic								NR
Barium								NR
Beryllium								NR
Cadmium		98.8372		81.6279		19.1		P
Calcium								NR
Chromium		160.4651		32.2093		133.1	*	P
Cobalt								NR
Copper								NR
Iron								NR
Lead		108.8372		67.4419		47.0	*	P
Magnesium								NR
Manganese								NR
Mercury								NR
Nickel								NR
Potassium								NR
Selenium								NR
Silver								NR
Sodium								NR
Thallium								NR
Vanadium								NR
Zinc								NR
Cyanide								NR

5A
SPIKE SAMPLE RECOVERY

SAMPLE NO.

V2-175NS

Lab Name: RECRA_ENVIRONMENTAL_INC._ Contract: NY95-143__

Lab Code: RECNY_ Case No.: 5281__ SAS No.: ______ SDG No.: 0864__

Matrix (soil/water): SOIL__ Level (low/med): LOW___

% Solids for Sample: _86.0

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

Analyte	Control Limit %R	Spiked Sample Result (SSR)	C	Sample Result (SR)	C	Spike Added (SA)	%R	Q	M
Aluminum_									NR
Antimony_									NR
Arsenic__									NR
Barium___									NR
Beryllium									NR
Cadmium__		105.3488_		98.8372		11.63	56.0		P_
Calcium__									NR
Chromium_	75-125_	75.3488_		160.4651		46.51	_-183.0	N	P_
Cobalt___									NR
Copper___									NR
Iron_____									NR
Lead_____	75-125_	1266.9767_		108.8372		116.28	996.0	N	P_
Magnesium									NR
Manganese									NR
Mercury__									NR
Nickel___									NR
Potassium									NR
Selenium_									NR
Silver___									NR
Sodium___									NR
Thallium_									NR
Vanadium_									NR
Zinc_____									NR
Cyanide__									NR

Comments:

HYDRO-SEARCH

5A
SPIKE SAMPLE RECOVERY

SAMPLE NO.

V3-175NS

Lab Name: RECRA_ENVIRONMENTAL_INC._ Contract: NY95-143__

Lab Code: RECNY_ Case No.: 5281__ SAS No.: ______ SDG No.: 0864__

Matrix (soil/water): WATER_ Level (low/med): LOW___

% Solids for Sample: __0.0

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

Analyte	Control Limit %R	Spiked Sample Result (SSR)	C	Sample Result (SR)	C	Spike Added (SA)	%R	Q	M
Aluminum									NR
Antimony									NR
Arsenic									NR
Barium									NR
Beryllium									NR
Cadmium		2342.0000		2262.0000		100.00	80.0		P
Calcium									NR
Chromium	75-125	365.0000		10.0000	U	400.00	91.2		P
Cobalt									NR
Copper									NR
Iron									NR
Lead	75-125	1636.0000		723.0000		1000.00	91.3		P
Magnesium									NR
Manganese									NR
Mercury									NR
Nickel									NR
Potassium									NR
Selenium									NR
Silver									NR
Sodium									NR
Thallium									NR
Vanadium									NR
Zinc									NR
Cyanide									NR

Comments:

FORM V (Part 1) - IN

HYDRO-SEARCH

5B
POST DIGEST SPIKE SAMPLE RECOVERY

SAMPLE NO.

V2-175NA

Lab Name: RECRA_ENVIRONMENTAL_INC._ Contract: NY95-143__

Lab Code: RECNY_ Case No.: 5281__ SAS No.: ______ SDG No.: 0864__

Matrix (soil/water) : SOIL__ Level (low/med): LOW___

Concentration Units: ug/L

Analyte	Control Limit %R	Spiked Sample Result (SSR)	C	Sample Result (SR)	C	Added (SA)	%R	Q	M
Aluminum									NR
Antimony									NR
Arsenic									NR
Barium									NR
Beryllium									NR
Cadmium									NR
Calcium									NR
Chromium		9439.00		1380.00		10000.0	80.6		P
Cobalt									NR
Copper									NR
Iron									NR
Lead		9907.00		936.00		10000.0	89.7		P
Magnesium									NR
Manganese									NR
Mercury									NR
Nickel									NR
Potassium									NR
Selenium									NR
Silver									NR
Sodium									NR
Thallium									NR
Vanadium									NR
Zinc									NR
Cyanide									NR

Comments:

HYDRO SEARCH
METHOD 8240 - TCL VOLATILE ORGANICS
METHOD BLANK SUMMARY

Client No.

VBLK 63

Lab Name: Recra Environmental   Contract: ______

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

Lab File ID: G2051.MSQ   Lab Sample ID: A5086406

Date Analyzed: 02/15/95   Time Analyzed: 14:50

GC Column: DB-624   ID: 0.53 (mm)   Heated Purge: (Y/N) Y

Instrument ID: I50G

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS AND MSD:

	CLIENT SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	TIME ANALYZED
1	V2-175N,80E	A5086401	G2060.MSQ	19:50
2	V2-175N,80E DL	A5086401DL	G2065.MSQ	23:24

Comments: ______

FORM IV - GC/MS VOA

HYDRO SEARCH
METHOD 8240 - TCL VOLATILE ORGANICS
ANALYSIS DATA SHEET

0021

Client No.

VBLK 63

Lab Name: Recra Environmental   Contract: ______

Lab Code: RECNY   Case No.: ______   SAS No.: ______   SDG No.: ______

Matrix: (soil/water) SOIL   Lab Sample ID: A5086406

Sample wt/vol: 5.00 (g/mL) G   Lab File ID: G2051.MSQ

Level: (low/med) LOW   Date Samp/Recv: ______ ______

% Moisture: not dec. ______   Heated Purge: Y   Date Analyzed: 02/15/95

GC Column: DB-624   ID: 0.53 (mm)   Dilution Factor: 1.00

Soil Extract Volume: ______ (uL)   Soil Aliquot Volume: ______ (uL)

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG

CAS NO.	COMPOUND	UG/KG	Q
67-64-1	Acetone	5	U
71-43-2	Benzene	5	U
75-27-4	Bromodichloromethane	5	U
75-25-2	Bromoform	5	U
74-83-9	Bromomethane	10	U
78-93-3	2-Butanone	5	U
75-15-0	Carbon Disulfide	5	U
56-23-5	Carbon Tetrachloride	5	U
108-90-7	Chlorobenzene	5	U
75-00-3	Chloroethane	10	U
67-66-3	Chloroform	5	U
74-87-3	Chloromethane	10	U
124-48-1	Dibromochloromethane	5	U
75-34-3	1,1-Dichloroethane	5	U
107-06-2	1,2-Dichloroethane	5	U
75-35-4	1,1-Dichloroethene	5	U
540-59-0	1,2-Dichloroethene (Total)	5	U
78-87-5	1,2-Dichloropropane	5	U
10061-01-5	cis-1,3-Dichloropropene	5	U
10061-02-6	trans-1,3-Dichloropropene	5	U
100-41-4	Ethyl benzene	5	U
591-78-6	2-Hexanone	5	U
75-09-2	Methylene chloride	5	U
108-10-1	4-Methyl-2-pentanone	4	U
100-42-5	Styrene	5	U
79-34-5	1,1,2,2-Tetrachloroethane	5	U
127-18-4	Tetrachloroethene	5	U
108-88-3	Toluene	1	J
71-55-6	1,1,1-Trichloroethane	5	U
79-00-5	1,1,2-Trichloroethane	5	U
79-01-6	Trichloroethene	0.9	J
108-05-4	Vinyl acetate	10	U
75-01-4	Vinyl chloride	10	U
1330-20-7	Total Xylenes	5	U

FORM I - GC/MS VOA

HYDRO SEARCH
METHOD 8240 - TCLP VOLATILES
METHOD BLANK SUMMARY

0022
Client No.

VBLK 74

Lab Name: Recra Environmental   Contract: ____

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

Lab File ID: L4720.RR   Lab Sample ID: A5086408

Date Analyzed: 02/17/95   Time Analyzed: 09:57

GC Column: DB-624   ID: 0.53 (mm)   Heated Purge: (Y/N) N

Instrument ID: I50L-A

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS AND MSD:

	CLIENT SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	TIME ANALYZED
1	EXTRACTOR BLANK	A5086403	L4724.RR	12:05
2	MATRIX SPIKE BLANK	A5086407	L4719.RR	09:26
3	V3-175N,80E	A5086402	L4725.RR	12:37
4	V3-175N,80E MS	A5086402MS	L4726.RR	13:08

Comments: ____

HYDRO SEARCH
METHOD 8240 - TCLP VOLATILES
ANALYSIS DATA SHEET

Client No.

VBLK 74

Lab Name: Recra Environmental Contract: ______

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

Matrix: (soil/water) SOIL Lab Sample ID: A5086408

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: L4720.RR

Level: (low/med) LOW Date Samp/Recv: ____ ____

% Moisture: not dec. ____ Heated Purge: N Date Analyzed: 02/17/95

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: ____ (uL) Soil Aliquot Volume: ____ (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) MG/L

CAS NO.	COMPOUND	MG/L	Q
71-43-2	Benzene	0.0050	U
78-93-3	2-Butanone	0.010	U
56-23-5	Carbon Tetrachloride	0.0050	U
108-90-7	Chlorobenzene	0.0050	U
67-66-3	Chloroform	0.0050	U
107-06-2	1,2-Dichloroethane	0.0050	U
75-35-4	1,1-Dichloroethene	0.0050	U
127-18-4	Tetrachloroethene	0.0050	U
79-01-6	Trichloroethene	0.0050	U
75-01-4	Vinyl chloride	0.010	U

HYDRO-SEARCH

3
BLANKS

Lab Name: RECRA_ENVIRONMENTAL_INC._ Contract: NY95-143__

Lab Code: RECNY_ Case No.: 5281__ SAS No.: ______ SDG No.: 0864__

Preparation Blank Matrix (soil/water): SOIL_

Preparation Blank Concentration Units (ug/L or mg/kg): MG/KG

Analyte	Initial Calib. Blank (ug/L)	C	Continuing Calibration Blank (ug/L) 1	C	2	C	3	C	Preparation Blank	C	M
Aluminum											NR
Antimony											NR
Arsenic											NR
Barium											NR
Beryllium											NR
Cadmium	10.0	U	10.0	U	10.0	U	10.0	U	1.000	U	P
Calcium											NR
Chromium	10.0	U	10.0	U	10.0	U	10.0	U	1.000	U	P
Cobalt											NR
Copper											NR
Iron											NR
Lead	30.0	U	30.0	U	30.0	U	30.0	U	3.000	U	P
Magnesium											NR
Manganese											NR
Mercury											NR
Nickel											NR
Potassium											NR
Selenium											NR
Silver											NR
Sodium											NR
Thallium											NR
Vanadium											NR
Zinc											NR
Cyanide											NR

HYDRO-SEARCH

3
BLANKS

Lab Name: RECRA_ENVIRONMENTAL_INC._ Contract: NY95-143__

Lab Code: RECNY_ Case No.: 5281__ SAS No.: ______ SDG No.: 0864__

Preparation Blank Matrix (soil/water): WATER

Preparation Blank Concentration Units (ug/L or mg/kg): UG/L_

Analyte	Initial Calib. Blank (ug/L)	C	Continuing Calibration Blank (ug/L) 1	C	2	C	3	C	Preparation Blank	C	M
Aluminum											NR
Antimony											NR
Arsenic											NR
Barium											NR
Beryllium											NR
Cadmium			10.0	U	10.0	U			10.000	U	P
Calcium											NR
Chromium			10.0	U	10.0	U			10.000	U	P
Cobalt											NR
Copper											NR
Iron											NR
Lead			30.0	U	30.0	U			30.000	U	P
Magnesium											NR
Manganese											NR
Mercury											NR
Nickel											NR
Potassium											NR
Selenium											NR
Silver											NR
Sodium											NR
Thallium											NR
Vanadium											NR
Zinc											NR
Cyanide											NR

HYDRO-SEARCH

3
BLANKS

Lab Name: RECRA_ENVIRONMENTAL_INC._ Contract: NY95-143__

Lab Code: RECNY_ Case No.: 5281__ SAS No.: ______ SDG No.: 0864__

Preparation Blank Matrix (soil/water): WATER

Preparation Blank Concentration Units (ug/L or mg/kg): UG/L_

Analyte	Initial Calib. Blank (ug/L)	C	Continuing Calibration Blank (ug/L) 1	C	2	C	3	C	Preparation Blank	C	M
Aluminum											NR
Antimony											NR
Arsenic											NR
Barium											NR
Beryllium											NR
Cadmium	10.0	U	10.0	U	10.0	U	10.0	U	10.000	U	P
Calcium											NR
Chromium	10.0	U	10.0	U	10.0	U	10.0	U	10.000	U	P
Cobalt											NR
Copper											NR
Iron											NR
Lead	30.0	U	30.0	U	30.0	U	30.0	U	30.000	U	P
Magnesium											NR
Manganese											NR
Mercury											NR
Nickel											NR
Potassium											NR
Selenium											NR
Silver											NR
Sodium											NR
Thallium											NR
Vanadium											NR
Zinc											NR
Cyanide											

HYDRO-SEARCH

3
BLANKS

Lab Name: RECRA_ENVIRONMENTAL_INC._ Contract: NY95-143__

Lab Code: RECNY_ Case No.: 5281__ SAS No.: ______ SDG No.: 0864__

Preparation Blank Matrix (soil/water): _____

Preparation Blank Concentration Units (ug/L or mg/kg): _____

Analyte	Initial Calib. Blank (ug/L)	C	Continuing Calibration Blank (ug/L) 1	C	2	C	3	C	Preparation Blank	C	M
Aluminum											NR
Antimony											NR
Arsenic											NR
Barium											NR
Beryllium											NR
Cadmium			10.0	U							P
Calcium											NR
Chromium			10.0	U							P
Cobalt											NR
Copper											NR
Iron											NR
Lead			30.0	U							P
Magnesium											NR
Manganese											NR
Mercury											NR
Nickel											NR
Potassium											NR
Selenium											NR
Silver											NR
Sodium											NR
Thallium											NR
Vanadium											NR
Zinc											NR
Cyanide											NR

HYDRO SEARCH
METHOD 8240 - TCL VOLATILE ORGANICS
VOLATILE INTERNAL STANDARD AREA AND RT SUMMARY

Lab Name: Recra Environmental   Contract: ______   Labsampid: AMG000166C

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

Lab File ID (Standard): G2048.MSQ   Date Analyzed: 02/15/95

Instrument ID: I50G   Time Analyzed: 12:50

GC Column(1): DB-624   ID: 0.530 (mm)   Heated Purge: (Y/N) Y

		IS1 (BCM) AREA #	RT #	IS2 (DFB) AREA #	RT #	IS3 (CBZ) AREA #	RT #
	12 HOUR STD	23483	11.85	70417	13.82	64960	18.60
	UPPER LIMIT	46966	12.35	140834	14.32	129920	19.10
	LOWER LIMIT	11742	11.35	35209	13.32	32480	18.10
	CLIENT SAMPLE						
1	V2-175N,80E	22593	11.75	66786	13.72	57753	18.52
2	V2-175N,80E DL	23212	11.73	69055	13.70	63463	18.48
3	VBLK 63	28258	11.72	80013	13.70	73811	18.52

		AREA UNIT QC LIMITS	RT QC LIMITS
IS1 (BCM)	= Bromochloromethane	(50-200)	-0.50 / +0.50 min
IS2 (DFB)	= 1,4-Difluorobenzene	(50-200)	-0.50 / +0.50 min
IS3 (CBZ)	= Chlorobenzene-D5	(50-200)	-0.50 / +0.50 min

Column to be used to flag recovery values
* Values outside of contract required QC limits

HYDRO SEARCH
METHOD 8240 - TCLP VOLATILES
VOLATILE INTERNAL STANDARD AREA AND RT SUMMARY

Lab Name: Recra Environmental   Contract: ________   Labsampid: AML000381C

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

Lab File ID (Standard): L4718.RR   Date Analyzed: 02/17/95

Instrument ID: I50L-A   Time Analyzed: 08:33

GC Column(1): DB-624   ID: 0.530 (mm)   Heated Purge: (Y/N) N

		IS1 (BCM) AREA #	RT #	IS2 (DFB) AREA #	RT #	IS3 (CBZ) AREA #	RT #
	12 HOUR STD	885405	10.28	3464962	12.50	3578187	17.43
	UPPER LIMIT	1770810	10.78	6929924	13.00	7156374	17.93
	LOWER LIMIT	442703	9.78	1732481	12.00	1789094	16.93
	CLIENT SAMPLE						
1	EXTRACTOR BLANK	843629	10.28	3333805	12.52	3516951	17.45
2	MATRIX SPIKE BLANK	892420	10.23	3498264	12.47	3356962	17.43
3	V3-175N,80E	830045	10.28	3358621	12.52	3575602	17.47
4	V3-175N,80E MS	851531	10.28	3419054	12.52	3539967	17.47
5	VBLK 74	873736	10.27	3416401	12.48	3247804	17.43

		AREA UNIT QC LIMITS	RT QC LIMITS
IS1 (BCM)	= Bromochloromethane	(50-200)	-0.50 / +0.50 min
IS2 (DFB)	= 1,4-Difluorobenzene	(50-200)	-0.50 / +0.50 min
IS3 (CBZ)	= Chlorobenzene-D5	(50-200)	-0.50 / +0.50 min

Column to be used to flag recovery values
* Values outside of contract required QC limits

APPENDIX B

LABORATORY REPORT FOR STABILIZED VOC IMPACTED SOILS

Volatile Organic Compounds - Analysis Data Sheet- Method/8240

SAMPLE NO. BV-1A

Lab Name: KANTI TECHNOLOGIES, INC. Client : Hydrosearch
Lab Code: 11358 Case No.: SAS No. SDG No.:
Lab Sample ID: 9410-946 Lab File ID: 162D Matrix: Soil
Date Sampled: 10/22/94 Date Received: 10/23/94 Date Analyzed: 10/24/94

CAS NO.	COMPOUND	MDL (ug/kg)	RESULTS (ug/kg)
75-71-8	Dichlorodifluoromethane	10	U
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl Chloride	10	U
75-00-3	Chloroethane	10	U
75-69-4	Trichlorofluoromethane	10	U
75-09-2	Methylene Chloride	10	U
75-35-4	1,1-Dichloroethene	10	U
75-34-5	1,1-Dichloroethane	10	U
594-20-7	2,2-Dichloropropane	10	U
156-59-4	Cis-1,2-Dichloroethene	10	U
156-60-5	*trans* - 1,2-Dichloroethene	10	U
74-97-5	Bromochloromethane	10	U
563-58-6	1,1-Dichloropropene	10	U
74-95-3	Dibromomethane	10	U
142-28-9	1,3-Dichloropropane	10	U
106-93-4	1,2-Dibromoethane	10	U
96-18-4	1,2,3-Trichloropropane	10	U
67-66-3	Chloroform	10	U
107-06-2	1,2-Dichloroethane	10	U
71-55-6	1,1,1-Trichloroethane	10	U
56-23-5	Carbon Tetrachloride	10	U
75-27-4	Bromodichloromethane	10	U
78-87-5	1,2-Dichloropropane	10	U
10061-02-6	*trans* - 1,3-Dichloropropene	10	U
10061-01-5	*cis* - 1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	10	26
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
110-75-8	2-Chloroethyl Vinyl Ether	10	U
75-25-2	Bromoform	10	U
79-34-5	1,1,2,2-Tetrachloroethane	10	U
127-18-4	Tetrachloroethene	10	U
71-43-2	Benzene	10	U
108-88-3	Toluene	10	4000
100-41-4	Ethylbenzene	10	6300
95-47-6	o-Xylene	10	U

Continuation of Sample : BY-1A *Lab I.D # 9410-946*

108-38-3	m-Xylene+p-Xylene	10	20000
108-90-7	Chlorobenzene	10	18000
95-50-11	1,2-Dichlorobenzene	10	U
541-73-1	1,3-Dichlorobenzene	10	U
106-46-7	1,4-Dichlorobenzene	10	U
100-42-5	Styrene	10	U
98-82-8	Isopropylbenzene	10	1200
103-65-1	n-propylbenzene	10	790
98-06-6	tert-Butylbenzene	10	U
135-98-8	sec-Butylbenzene	10	U
95-63-6	1,2,4-Trimethylbenzene	10	1000
108-67-8	1,3,5- Trimethylbenzene	10	460
99-87-6	4-Isopropyltoluene	10	U
104-51-8	n-Butylbenzene	10	U
96-12-8	1,2-dibromo-3-chloro Propane	10	U
120-82-1	1,2,4-trichloro Benzene	10	U
87-68-3	Hexachlorobutadiene	10	U
91-20-3	Naphthalene	10	630
87-61-6	1,2,3-trichloro Benzene	10	U

U - Indicates that compound was analyzed for but not detected.
MDL - Method Detection Limit

Stabilized Soil - B

Volatile Organic Compounds - Analysis Data Sheet- Method/8240

SAMPLE NO. GS-01

Lab Name: KANTI TECHNOLOGIES, INC. Client : Hydrosearch
Lab Code: 11358 Case No.: SAS No. SDG No.:
Lab Sample ID: 9411-36 Lab File ID: 173D Matrix: Soil
Date Sampled: 11/03/94 Date Received: 11/03/94 Data Analyzed: 11/04/94

CAS NO.	COMPOUND	MDL (ug/kg)	RESULTS (ug/kg)
75-71-8	Dichlorodifluoromethane	50	U
74-87-3	Chloromethane	50	U
74-83-9	Bromomethane	50	U
75-01-4	Vinyl Chloride	50	U
75-00-3	Chloroethane	50	U
75-69-4	Trichlorofluoromethane	50	U
75-09-2	Methylene Chloride	50	U
75-35-4	1,1-Dichloroethene	50	U
75-34-5	1,1-Dichloroethane	50	U
594-20-7	2,2-Dichloropropane	50	U
156-69-4	Cis-1,2-Dichloroethene	50	U
156-60-5	*trans* - 1,2-Dichloroethene	50	U
74-97-5	Bromochloromethane	50	U
563-58-6	1,1-Dichloropropene	50	U
74-95-3	Dibromomethane	50	U
142-28-9	1,3-Dichloropropane	50	U
106-93-4	1,2-Dibromoethane	50	U
96-18-4	1,2,3-Trichloropropane	50	U
67-66-3	Chloroform	50	U
107-06-2	1,2-Dichloroethane	50	U
71-55-6	1,1,1-Trichloroethane	50	U
56-23-5	Carbon Tetrachloride	50	U
75-27-4	Bromodichloromethane	50	U
78-87-5	1,2-Dichloropropane	50	U
10061-02-6	*trans* - 1,3-Dichloropropene	50	U
10061-01-5	*cis* - 1,3-Dichloropropene	50	U
79-01-6	Trichloroethene	50	5600
124-48-1	Dibromochloromethane	50	U
79-00-5	1,1,2-Trichloroethane	50	U
110-75-8	2-Chloroethyl Vinyl Ether	50	U
75-25-2	Bromoform	50	U
79-34-5	1,1,2,2-Tetrachloroethane	50	U
127-18-4	Tetrachloroethene	50	U
71-43-2	Benzene	50	7900
108-88-3	Toluene	50	6800
100-41-4	Ethylbenzene	50	18000
95-47-6	o-Xylene	50	24000

Continuation of Sample : GS-01 *Lab I.D # 9411-36*

508-38-3	m-Xylene+p-Xylene	50	130000
508-90-7	Chlorobenzene	50	U
95-50-11	1,2-Dichlorobenzene	50	U
541-73-1	1,3-Dichlorobenzene	50	U
506-46-7	1,4-Dichlorobenzene	50	U
500-42-5	Styrene	50	U
98-82-8	Isopropylbenzene	50	U
503-65-1	n-propylbenzene	50	U
98-06-6	tert-Butylbenzene	50	U
135-98-8	sec-Butylbenzene	50	U
95-63-6	1,2,4-Trimethylbenzene	50	U
508-67-8	1,3,5- Trimethylbenzene	50	U
99-87-6	4-Isopropyltoluene	50	U
504-51-8	n-Butylbenzene	50	U
96-12-8	1,2-dibromo-3-chloro Propane	50	U
120 82 1	1,2,4-trichloro Benzene	50	U
87-68-3	Hexachlorobutadiene	50	U
91-20-3	Naphthalene	50	U
87-61-6	1,2,3-trichloro Benzene	50	U

U - Indicates that compound was analyzed for but not detected.
MDL - Method Detection Limit

Volatile Organic Compounds - Analysis Data Sheet- Method/8240

SAMPLE NO. Blank

Lab Name: KANTI TECHNOLOGIES, INC.
Lab Code: 11358 Case No.:
Lab Sample ID: 9411Blank Lab File ID 172D
Date Sampled: NA Date Received: NA

Client : Hydrosearch
SAS No. SDG No.:
Matrix: Soil
Date Analyzed: 11/04/94

CAS NO.	COMPOUND	MDL (ug/kg)	RESULTS (ug/kg)
75-71-8	Dichlorodifluoromethane	50	U
74-87-3	Chloromethane	50	U
74-83-9	Bromomethane	50	U
75-01-4	Vinyl Chloride	50	U
75-00-3	Chloroethane	50	U
75-69-4	Trichlorofluoromethane	50	U
75-09-2	Methylene Chloride	50	U
75-35-4	1,1-Dichloroethene	50	U
75-34-5	1,1-Dichloroethane	50	U
594-20-7	2,2-Dichloropropane	50	U
156-69-4	Cis-1,2-Dichloroethene	50	U
156-60-5	*trans* - 1,2-Dichloroethene	50	U
74-97-5	Bromochloromethane	50	U
563 58 6	1,1-Dichloropropene	50	U
74-95-3	Dibromomethane	50	U
142-28-9	1,3-Dichloropropane	50	U
506-93-4	1,2-Dibromoethane	50	U
96-18-4	1,2,3-Trichloropropane	50	U
67-66-3	Chloroform	50	U
507-06-2	1,2-Dichloroethane	50	U
71-55-6	1,1,1-Trichloroethane	50	U
56-23-5	Carbon Tetrachloride	50	U
75-27-4	Bromodichloromethane	50	U
78-87-5	1,2-Dichloropropane	50	U
50061-02-6	*trans* - 1,3-Dichloropropene	50	U
50061-01-5	*cis* - 1,3-Dichloropropene	50	U
79-01-6	Trichloroethene	50	U
124-48-1	Dibromochloromethane	50	U
79-00-5	1,1,2-Trichloroethane	50	U
150-75-8	2-Chloroethyl Vinyl Ether	50	U
75-25-2	Bromoform	50	U
79-34-5	1,1,2,2-Tetrachloroethane	50	U

Continuation of Sample : Blank *Lab I.D # 9411Blank*

127-18-4	Tetrachloroethene	50	U
71-43-2	Benzene	50	U
508-88-3	Toluene	50	U
500-41-4	Ethylbenzene	50	U
95-47-6	o-Xylene	50	U
508-38-3	m-Xylene+p-Xylene	50	U
508-90-7	Chlorobenzene	50	U
95-50-11	1,2-Dichlorobenzene	50	U
541-73-1	1,3-Dichlorobenzene	50	U
506-46-7	1,4-Dichlorobenzene	50	U
500-42-5	Styrene	50	U
98-82-8	Isopropylbenzene	50	U
503-65-1	n-propylbenzene	50	U
98-06-6	tert-Butylbenzene	50	U
135-98-8	sec-Butylbenzene	50	U
95-63-6	1,2,4-Trimethylbenzene	50	U
508-67-8	1,3,5-Trimethylbenzene	50	U
99-87-6	4-Isopropyltoluene	50	U
504-51-8	n-Butylbenzene	50	U
96-12-8	1,2-dibromo-3-chloro Propane	50	U
120-82-1	1,2,4-trichloro Benzene	50	U
87-68-3	Hexachlorobutadiene	50	U
91-20-3	Naphthalene	50	U
87-61-6	1,2,3-trichloro Benzene	50	U

U - Indicates that compound was analyzed for but not detected.
MDL - Method Detection Limit

APPENDIX C

BIOLOGICAL TREATMENT TECHNICAL MEMORANDUM

TECHNICAL MEMORANDUM

Biological Soil Treatment Technologies - Motorola, Arcade

1.0 Background and Objectives

The Motorola site in Arcade, New York has approximately 5,800 cubic yards (cy) of soils impacted with VOCs and metals. The VOCs of concern include BTEX, TCE and Chlorobenzene while the metals of concern include Cadmium, Chromium and Lead. Table 2-1 of the main text describes impacts to the soils and anticipated cleanup goals. Soils are largely silts and sandy silts with some gravelly and sandy strata. The anticipated maximum depth of impact is approximately 12 to 14 feet (to the ground water surface).

Bioremediation has been identified as a potential treatment technology for remediating the impacted soils at the Arcade site. The objective of this review is to evaluate the bioremediation option as a feasible and effective treatment technology at the Arcade site, explore its advantages and limitations and determine a range of potential costs.

2.0 Bioremediation

Bioremediation techniques use micro-organisms to break down, modify or destroy contaminants through their natural enzymatic activities. Bioremediation can be carried out either ex-situ (i.e., after removal of the contaminated soil or water from the ground), or in-situ (i.e., without removal or excavation).

The costs for biological treatment can range from $75 to $150 per cubic yard. However, there are several advantages and disadvantages to using the bioremediation process. It can be used to treat organic compounds, particularly the water soluble pollutants. It is environmentally sound since bioremediation does not usually generate toxic waste products. It utilizes indigenous microbes and the process is often economical.

The disadvantages are that vinyl chloride, which is more difficult to destroy and more toxic than its parent VOCs may be a by-product of bioremediation. Also, microbes may be inhibited by heavy metals and some organics found at the site. In-situ flow and transport limitations can make treatment difficult and introduction of nutrients could adversely affect nearby ground water and surface water. In addition, residues may cause taste and odor problems, labor and maintenance requirements can be high for ex-situ systems and long-term effects are unknown.

In-Situ Bioremediation

In-situ biological remediation of unsaturated soils utilizes naturally occurring soil micro-organisms to degrade the chemical contaminants. Indigenous micro-organisms present in the soil are stimulated by providing those elements, usually oxygen, nitrogen and phosphorus, that are limiting the degradation of the organic compounds. In-situ bioremediation techniques are feasible where excavation and treatment or disposal would be too expensive or impractical, and where the chemicals are not easily removed by vapor extraction.

The following general comments can be made to assist the decision on whether to use in-situ bioremediation. Main issues to be reviewed as a first stage include:

- Soil structure and hydrogeology
  - heterogeneity of the subsoil
  - permeabilities (horizontal nd vertical)
  - organic carbon content
- Microbiology
  - bacterial counts
  - enrichment cultures
  - biodegradation tests either in batches and/or soil columns
  - pilot investigation at complex sites
- Contamination
  - Comprehensive site investigation
  - types of contaminants and concentration levels
  - free-floating layers

At the Arcade site, in-situ bioremediation is not considered a feasible stand-alone option due to the presence of metals and heterogeneous low permeability soils. It should be noted that in-situ bioremediation of the vadose zone through recirculation of water and nutrients is experimental and presents a potential threat to ground water.

Bioventing may be a feasible alternative for treating the unsaturated zone in lieu of in-situ bioremediation but suffers from potential inhibition by metals.

Ex-Situ Bioremediation

In this process, impacted soils are excavated and treated above ground, generally in an aerobic environment. Other factors such as soil structure, presence of micro-organisms (native or augmented), nutrient delivery systems, etc., remain the same as discussed earlier for in-situ bioremediation.

A treatability study is required to determine whether or not indigenous or preacclimated organisms must be used. Generally, 1,000 cy lots of soil can be remediated in approximately 30 to 60 days during warm weather. During the winter, twice the time or more may be required, as respiration drops approximately 50% for each 15-20 degree drop in temperature below 70°F. A treatability study is required for each soil body remediated. Soil pH is maintained above 6.5, but below 7.9 by application of magnesium oxide if the pH falls below 6.5. In this manner, the agricultural value of the soil is enhanced as the soil is remediated.

Soils are spread 6 inches to a maximum of 24 inches deep on an approved liner, typically of 20 mil poly or PVC construction. Soil may be turned once weekly or stirred. Each week during treatment, a soil sample is collected and sent to a soil microbiology laboratory where a plate count is completed. Following remediation, depending upon regulatory input, the soils may be abandoned in place, utilized agriculturally, or for other purposes.

A berm of clean soil surrounding the site should be erected prior to installation of the liner. The berm should be high enough to permit a full foot of freeboard above the surface of the soil being treated. If the site is located in an area where flooding may be a problem within the treatment area, a plastic sheet should be laid over the soil being treated, so that the excess water can be pumped or siphoned out of the basin following the precipitation events, instead of being absorbed by the soil. The edges of the plastic sheet should extend over all four sides of the berm, so that no contact is possible between the soil and the precipitation captured above the plastic cover.

Another method of ex-situ bioremediation is by utilizing a bioslurry reactor above ground. The soil is prepared and converted into a slurry prior to treatment in a bioreactor with suitable micro-organisms and treatment agents to achieve the remediation goals. Experience with bioslurry reactors for treatment of contaminated soils is limited.

At the Arcade site, ex-situ bioremediation appears to be a feasible alternative. However, the presence of metals in toxic concentrations will hinder the effectiveness of microbiological biodegradation of organic compounds. Soil washing to remove the metals and then bioremediation as a polishing step for treating the organic compounds may have to be considered.

Recalcitrant Molecules

As stated earlier, the presence of metals (Cd, Cr and Pb) and chlorinated VOCs (TCE, PCE, etc.) may inhibit the microbial activity and effectiveness of biodegradation. Assuming that the metals have been removed (i.e., by soil washing) the bioremediation will be very effective for those substances which are either non-recalcitrant (non-refractory, offering little resistance to biological degradation) or which exhibit only a low or medium degree of recalcitrance.

Recalcitrant (Refractory) Molecules are those which resist biodegradation. The six refractory VOCs of greatest concern can be rated as **High** (1,2=dichloroethane and vinyl chloride), **Medium** (trichloroethylene and tetrachloroethylene) or **Low** (carbon tetrachloride and 1,1,1-trichloroethane) in degree of recalcitrance.

3.0 Vendor/Literature Search

The following vendors were contacted:

- BioGenesis Enterprises, Inc.
  Tom Rogeaux
  10626 Beechnut Court
  Fairfax Station, VA 22309
  (703) 913-9700
- Bio-Rem, Inc.
  David Mann/Michael Hostetter
  (719) 868-5873
- BioTrol, Inc.
  Dennis Chileote
  11 Pearey Road
  Chaska, MN 55318
  (612) 448-2515
  Provide only equipment.
- Ecova Corporation
  Bob Hampton
  800 Jefferson County
  Golden, CO 80401
  (303) 279-9712
- BioRemedial Technologies, Inc.
  William P. Griffin
  7 Industrial Drive
  Harrington, PA 16148
  (412) 981-1994
- Sybron, Inc.
  Mr. Herb Jernigan
  Box 66
  Birmingham, NJ 08011
  (609) 893-1100

APPENDIX D

THERMAL DESORPTION TECHNICAL MEMORANDUM

TECHNICAL MEMORANDUM

Thermal Desorption Vendor Contacts

Objective:

To research the overall effectiveness of thermal desorption technology in treating the VOC contaminated soil portion of the Motorola Arcade site relative to other available remedial technologies.

Description:

Thermal desorption is a process by which the volatile organic contamination in a soil mass is reduced or eliminated by the application of heat in which the contaminants are driven from the soil, carried via steam or nitrogen gas, and condensed in a collector. The contents of the collector can then be disposed of properly. The process is sensitive to fine soil, dust and the moisture content of the soil mass. Moisture contents above 20% can significantly increase the cost. The process can be applied either in-situ or ex-situ, although in-situ thermal desorption is rarely used an was not considered for the Arcade site.

The end product of the technology is a clean soil (clean with respect to VOCs), and, possibly, a small matrix of concentrated contaminants. The contaminated matrix may require disposal as hazardous waste. At the Arcade site, the "clean" soil
will still be contaminated with inorganics.

Vendor/Literature Search:

The following vendors were contacted and asked to provide information on thermal desorption technology:

- McLaren Hart
  Mr. Phil Crincoli
  Lester, PA
  (908) 505-3090

- Westinghouse Remediation
  Mr. Bruno Pertillo
  Philadelphia, PA
  (215) 699-6300

Mr. Crincoli provided general specifications and costs over the telephone based upon the site information. For the volume of material to be treated, he recommended four IRV-100 units which together could process 20 tons per hour. The treatment costs would be between $40/ton and $60/ton (including mobilization and demobilization). Excavation costs are not included. Mr. Crincoli cautioned that moisture contents exceeding 20% would seriously affect the treatment process.

Mr. Pertillo also provided general specifications and costs over the telephone. His treatment costs would be between $80/ton and $120/ton (including mob/demob). Excavation costs are not included.

Conclusions:

Based on the evaluations presented, thermal desorption for the VOC contamination will be feasible at the site for a cost of between $40 and $120 per ton (this does not include the disposal of any residual or end products). These prices do not include excavation or backfilling costs. Considering the unit cost figures being presented, thermal desorption does not offer significant advantages over other technologies that would justify the added expense.

APPENDIX E

SOIL STABILIZATION TECHNICAL MEMORANDUM

TECHNICAL MEMORANDUM

TREATMENT TECHNOLOGIES FOR MOTOROLA ARCADE

REMEDIATION BY STABILIZATION

Objective: Evaluate available technologies for remediation of soils contaminated with inorganics and organics using solidification or stabilization techniques. Specifically to determine if organics can be treated simultaneously with the inorganics and also to determine typical volume increases using various solidification reagents.

Key factors in the evaluation include:

- Ability of the technology to modify contaminated material to comply with the NYSEC requirements as well as the RCRA requirements
- Cost
- Net volume increase of material as the result of the remediation
- Are treatability studies required and how much do they typically cost?

Description: Remediation by solidification relies on the addition of material to contaminated soils to prohibit the leaching of the contaminants from the soil. Typically the added material is some sort of cement or lime. This treatment is effective for metals, and apparently sometimes for volatile organic compounds, if concentrations are low enough. However, this methodology typically results in a significant increase in volume, that is the volume of treated material is greater than the feed.

Modifications to the solidification process can be made which will reduce the amount of solidification agent which needs to be added to the contaminated materials. These modifications include the addition of reagents that destroy organic compounds or transform contaminants into less mobile forms (stabilization). Typically these materials are selected using treatability studies to evaluate the effectiveness of the various processes and insure that the treatment technology is suitable for the intended use.

Innovations to address contaminants investigated during this treatment technology review included "chemical organic destruct technology" which oxidizes or dechlorinates selected organic compounds to reduce total contaminant concentrations. Leachable organic contaminant concentrations are also reduced. Inorganic contaminant chemical fixation/solidification technology involves formation of insoluble chemical compounds, reducing leachable contaminant concentrations. The proprietary reagents selectively adsorb contaminants. In some cases, the waste is mixed with a cement-like material to form a high-strength, non-leaching monolith (STC Remediation, Inc.).

Vendor/Literature Search -

The vendors on Table 1 were contacted to determine their ability to meet the goals of the project. Information on the method(s) of remediation presented by each of the vendors is briefly detailed below.

Advanced Remediation Mixing (ARM)

Advanced Remediation Mixing's primary service is the implementation of the actual on-site work once reagents and processes have been defined by the consultant. They do not do treatability studies or provide reagent information. They are strictly a "yellow metal" company. No direct information pertaining to the treatment of organics is available other than coincidental reductions as a result of the solidification processes.

ARM turnkey stabilization costs are typically $28-31 per cubic yard, including reagents, mobilization, labor, and equipment. A treatability study is recommended to ensure proper treatment. This could be subcontracted by ARM and, if chemistry only was evaluated, the cost is estimated at $25,000.

ENRECO Technologies Group

ENRECO Technologies Group recommends stabilization/solidification to precipitate metals into an insoluble salt and during the stabilization/solidification process adding a reagent to produce an exothermic reaction to drive off the volatiles. Other alternatives include adsorbing the organic compounds to activated carbon or an "ion" exchange resin then solidifying the material to physically trap the particulates. The second two methods do not reduce the total volatile content but would reduce leachable organics. ENRECO feels that if a method that adds heat was used for mixing, the VOCs would be driven off. Based on the levels currently in the soils, the solidified material will not exceed the toxic characterization levels.

ENRECO recommends completion of a treatability study to confirm contaminant concentrations following treatment. The treatability study would likely range from $3000 to $15,000 and could be completed by ENRECO.

Treatment costs would likely range from $30-35/ton to address both organic and inorganic treatment and material handling.

Ensotech, Inc.

Ensotech, Inc. does not use treatability studies. They use the initial concentrations and treatment goals to determine quantities of reagent to use. They use two types of reagents, one to address organics and a second to address inorganics. The processes would require multiple handling of the soil to complete the various processes.

Organics are treated through the addition of two products which oxidize volatile and nonvolatile hydrocarbons, then provide a synthetic polysilicate with a large surface area for adsorption of VOCs which prevent escape to the atmosphere until oxidation is complete. As a side reaction, one of the products also reacts with cations, specifically heavy metals, converting them to metal silicates. Ensotech uses the proprietary chemical fixation process to fix heavy metals in soil without altering the volume, texture, or physical properties of the soil. The chemicals combine with the heavy metals to form non-leachable polysilicates. The fixation is instantaneous, irreversible, and requires virtually no curing time or external heat. The process meets or exceeds the USEPA's TCLP requirements. Treatment costs for metals only are estimated at $40-$50 per ton.

Geo-Con, Inc.

Geo-Con, Inc. has specialized mixing tools but does not do treatability studies or select reagents for remediation. To implement the actual remediation, Geo-Con estimated that the cost would be $30 to $50 per cubic yard (probably closer to $50) plus mobilization of $50,000. They sub out the treatability study which typically ranges from $15-20,000 depending on how much information is needed. Again, this is another "yellow metal" company.

RMT, Inc.

RMT, Inc. does not conduct processes which address organics directly; however, they have chemical fixation technology to address the heavy metals. RMT uses common forms of phosphates or phosphoric acid with many buffering agents to treat lead and cadmium. They use chemical fixation to treat select metals and their methods have typically resulted in project savings of 10 to 75 % over conventional methods. A treatability study is recommended but may cost as little as $1,000 if contaminant concentrations do not vary greatly within the material requiring treatment. RMT's costs for fixation range from $40 to $60 per ton, which includes all site work, chemicals, labor and equipment.

Separation and Recovery Systems, Inc.

Separation and Recovery Systems, Inc, (SRS) has a chemical fixation process which is a thermal and chemical reactive (fixation) process that removes VOCs and stabilizes the remaining organic and inorganic constituents in soils. The process uses specially-prepared lime and proprietary, non-toxic chemicals to catalyze and control the reactions. Unfortunately the high pH produced by the addition of the lime prevents the stabilization of the lead which would normally precipitate as an insoluble lead plumbate. As a result, SRS recommends a two step process to treat the soil. Initially thermal desorption would be used to address the organics, followed by heavy metal stabilization using cement or pozzolans. This two step process does not provide any advantages for the Motorola site.

SRS would require a treatability study which they would complete themselves for not more than $10,000. Treatment costs are estimated at $75 to $100/ ton for thermal desorption plus $30/ton for solidification.

STC

STC (formerly Silicate Technology Corporation) has a treatment process which oxidizes, polymerizes or dechlorinates selected organic compounds to reduce total contaminant concentrations. This process typically results in a volume increase of 25%. The process also reduces the mobility of the remaining organic contaminants of concern by chemically fixating the organic contaminant while reducing the interference of the organic contaminants with the solidification matrices. This results in a treated material where the mobility or leachability of the organic contaminants are significantly reduced, The final steps in the treatment process are hydration reactions resulting in the solidification of the treated waste mass. The end products are primarily calcium aluminum silicates. They are extremely stable and will not break down in natural environments.

STC has specific proprietary stabilization/fixation technologies which have been used on hazardous waste sites with high leachable contaminant concentrations, where extremely low treated leachable contaminant concentrations are required. This process may be completed at the same time as the treatment process used for organics, however a treatability study would be required to confirm this.

The treatability study completed by STC may cost as little as $2000 depending on the requirements for clean-up. Typical costs for stabilization are $60 to $90 per cubic yard including contracting, reagents, equipment and labor.

Wastech, Inc.

Wastech, Inc. applies benign chemical reagents, coupled with certain catalysts, to organic solvents which causes spontaneous molecular bonding. The reagents are nonhazardous and their application to the organic solvents decreases the overall toxicity of the waste pollutants by altering their molecular structure. As a second phase, an additional additive is applied and mixed with the materials which form bonds with the treated material. This results in the formation of nonhazardous complex molecules. The final treated mixture is placed into a pozzolanic-cementitious matrix which binds the pollutants to keep them in their "de-toxified state" and creates a barrier to assist in prohibiting corrosive contaminants from interfering with the molecular bonds.

A treatability study is required to confirm the effectiveness of this process and optimize the reagent additions. A treatability study is estimated to cost a minimum of $4,500. Treatment costs are estimated at $90 to $140 per ton plus $8 to $12 per ton for excavation and earth moving work.

Conclusions

- Solidification alone is unlikely to meet the cleanup criteria for site soils. Each of the vendors has indicated their proven ability to meet remediation cleanup goals for heavy metals using solidification, stabilization, or chemical fixation. Many of the vendors also have proprietary methods for treating or dealing with organics using these methods or variations. However, none of the vendors could provide convincing documentation to confirm their ability to address organic and inorganic contaminants successfully in a single treatment process. As a result, a recommendation for solidification/stabilization/fixation alone without additional treatment to address organic constituents directly could not be justified based on technology available today. For effective heavy metal treatment, solidification, stabilization, and fixation are technologies which have been field tested and proven at remedial projects.

- Costs for solidification processes to address heavy metals only range from $35 to $140 per ton with a mean of approximately $50 per ton.

- Net volume increase as the result of remediation by solidification, stabilization, or fixation ranged from an estimated 4% to in excess of 30%. Most vendors indicated that an increase of 20 to 30% is common.

- The need for treatability studies and the cost of the study varied by vendor. Most recommended that studies be completed and a few required that some form of testing prior to startup be done. Costs for the testing ranged from $1,000 to in excess of $25,000.

In summary, available information indicates that solidification/stabilization/fixation is appropriate to address heavy metal contamination but technologies for addressing metals and organics in a single solidification type treatment process have not proven to be without major problems or great expense. A separate nonsolidification type treatment to address the organic constituents is recommended prior to implementing solidification technologies to address heavy metal contaminantss.

Table 1. Summary of Potential Stabilization/Solidification Vendors

Advanced Remediation Mixing, Inc.	Sam V. Pizzitola III 504-461-0466	711 Oxley St Kenner, LA 70062
Ensotech, Inc.	Inderjit Sabherwal 818-767-2222	7949 Ajay Drive Sun Valley, CA 91352
ENRECO, Inc.	Thomas de Grood 806-379-6424	Post office Box 9838 Amarillo Texas 79105
Geo-Con, Inc.	Linda Ward 412-856-7700	4075 Monroeville Blvd, Ste.400 Monroeville, PA 14246
RMT, Inc.	Chris Raymond 680-831-4444	744 Heartland Trail Madison, WI 53717
Separation and Recovery Systems, Inc.	Bradford Miller 714-261-8860	1762 McGaw Ave. Irvine, CA 92714
STC (formerly Silicate Technology Corp.)	Scott Larsen or Stephen Pegler 602-948-7100	7655 E. Gelding Dr. Ste B-2 Scottsdale, AZ 85260
Wastech, Inc.	E. Benjamin Peacock 615-483-6515	114 Tulsa Road Oak Ridge, TN 37830

APPENDIX F

SOIL WASHING TECHNICAL MEMORANDUM

TECHNICAL MEMORANDUM

Soil Washing Vendor Contacts and Request for Technical Information

Objective:

To research the overall effectiveness of soil washing technology for organic and inorganic removal in the VOC contaminated soil portion of the Motorola Arcade site relative to other available remedial technologies.

Description:

Soil washing is a process by which contamination in a soil mass is reduced by selectively removing fines and organic materials in which the contaminants are assumed to have preferentially accumulated, resulting in a smaller, more highly concentrated volume of contaminated soil. As such, it is sensitive to the percentage of fines in the soil mass (i.e., a soil comprised entirely of fines cannot be segregated and is not amenable to the process). Secondary circuits and proprietary solutions are sometimes used to leach and/or further concentrate contaminants for subsequent destruction or filtration. The process can be used in-situ or ex-situ, although in-situ soil washing is rarely used and was not considered for the Arcade site.

After fine materials have been removed, the remaining coarse fraction of the soil matrix is, if necessary, washed using a solution designed to remove the contaminants of concern, typically resulting in a low residual contamination sand and gravel matrix, suitable for use as backfill or aggregate. The fine materials are similarly processed and, depending on initial and target conditions, are either further segregated or washed. Wash solutions are typically recycled as part of the process, reducing end product wastes.

The end product of the technology is a relatively clean coarse soil, a relatively clean portion of the fine soil fraction, concentrated contaminants in a fine soil mass or sludge matrix (as much as 3,600 tons based upon the percentage of fines in the soil) and spent washing solutions with potential contaminants. Some of the end product materials may require disposal as hazardous wastes.

Vendor/Literature Search:

The following vendors were contacted and asked to provide information on soil washing technology:

- Alternative Remedial Technologies, Inc. (ART)
  Mr. Michael J. Mann
  14497 North Dale Mabry Highway
  Suite 140
  Tampa, FL 33618
  (813) 264-3506

- Bergmann, U.S.A.
  Mr. Richard Traver
  1550 Airport Road
  Gallatin, TN 37066
  (615) 452-5550

- BioGenesis Enterprises, Inc.
  Mr. Thomas Rougeux
  7420 Alban Station Blvd.
  Suite B-208
  Springfield, VA 22150
  (703) 913-9700

- COGNIS/Bescorp
  Dr. William E. Fristad
  2330 Circadian Way
  Santa Rosa, CA 95407
  (800) 524-3307

- Dr. Itzhak Gotlieb
  5 Balsam Court
  Roseland, NJ 07068
  (201) 226-4642

After initial contact, each of the vendors was provided with an information packet describing initial site conditions and preliminary remedial objectives. The package also requested specific information as to the suitability of this technology to the site.

No response was received from Bergmann, in spite of two phone conversations. Dr. Gotlieb responded with a reprint of a published article describing laboratory and pilot scale soil washing projects he had been involved with, but did not include a cover letter addressing site specific questions.

The remaining firms (ART, BioGenesis and COGNIS/Bescorp) provided information that directly addressed site needs. Each of the individuals contacted from these firms requested and were supplied with additional site data including a sterilized site map, grain size distribution and other qualitative information. Additionally, each of the vendors contacted was supplied with a revised table describing preliminary remedial targets.

Results:

Each of the responding vendors described their particular process, results and experience. They also expressed varying opinions on the effectiveness and cost of the process. None of the vendors specified whether costs included excavation; therefore, excavation costs are assumed to be extra. Responses of the three vendors who responded substantively are summarized below.

<u>ART</u>

ART has significant soil washing experience in Europe and has completed pilot and full-scale projects at the King of Prussia (KOP) site in Winslow Township, New Jersey, involving the removal of heavy metals. They have also completed a pilot study for the removal of uranium and other heavy metals at the Hanford, Washington site for the DOE. In addition to the pilot and full-scale projects, they have conducted a number of treatability studies. They apparently do not have specific experience in removal of VOCs using soil washing.

Approximately 19,200 tons of soils at the KOP site were treated for nickel, chromium and copper, with concentrations ranging from 300 to 3,500 mg/kg for nickel, 500 to 5,500 mg/kg for chromium and 800 to 8,500 mg/kg for copper. Clean product concentrations were reported as 25, 73 and 110 mg/kg, respectively, with a 90 percent reduction of solids on a dry basis.

The Hanford pilot study achieved a 90 percent reduction in solids by weight and demonstrated that standards could be met for heavy metals and radionuclides at the site using soil washing.

ART is also capable of other proven remedial technologies, including soil vapor extraction and bioremediation. In their analysis of the site, they recommend a soil vapor extraction system with subsequent stabilization to address the metals. Their estimated cost of the SVE system is $140,000 to $170,000, with $40 to $50 per ton for stabilization. The SVE is estimated to take "a few months". Their estimated cost for soil washing was in the range of $140 to $170 per ton. Their assessment of the use of soil washing was that there are potentially too many fines (53%) and that initial VOC levels were too high to be effectively treated without pretreatment using SVE.

COGNIS/Bescorp

COGNIS and Bescorp have completed "many treatability studies, pilot tests and a full scale project at the Twin Cities Ammunition Plant, where remedial objectives of less than 175 ppm residual lead were reportedly met. No specific experience in VOC impacted soils was described in their correspondence.

COGNIS recognizes the relatively high percentage of fines (approximately 50%) in the soil, however, they think that it is likely that their process will work to reduce the organics and metals, with the organics being removed from the washing solution using a stripping or biodegradation process. They also recognize the need for a treatability study before proceeding. they quote a price of $10,000 for the study. Their order of magnitude price for the soil washing is $100 to $150 per ton, with a processing time of 50 to 100 days.

BioGenesis

BioGenesis has completed a full scale soil washing project at a refinery in Minneapolis and a SITE treatability study at the Santa Maria Health Care facility in Santa Maria, California. Both of these sites were contaminated with crude oil. Treatability standards were met for both projects.

BioGenesis feels that their process will work at the site, but recommend bench-scale testing before proceeding. Their order of magnitude pricing is approximately $110 per ton, and they quote $5,000 for a bench-scale test. They estimate a project duration of about two months. Organics in the wash water are destroyed during the process, leaving residual metals to be disposed.

Conclusions:

Based on the evaluations presented, soil washing will be feasible at the site for a cost of between $100 and $170 per ton. The cost for disposal of any residual or end products would be extra. In addition, two of the three vendors recommend treatability studies for an additional $5,000 to $10,000. None of the vendors have specific experience with the combination of VOC and heavy metals contamination. Excavation and backfilling costs are assumed to be extra. Soil washing should be effective for the inorganic fraction in the soil mass; however, the effect on the organic fraction is not known.

One of the vendors who possesses the capability of other remedial technologies recommended SVE with soil stabilization as the preferred approach. Considering the unit cost figures being presented, soil washing does not offer significant advantages over other technologies that would justify the added expense.

APPENDIX G

SCORING SHEETS

ALTERNATIVE A: In-Situ SVE/Solidification

SITE NAME:
SITE NUMBER:

Table 5.2

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

(Maximum Score = 10)

Analysis Factor	Basis for Evaluation During Preliminary Screening		Score
1. Compliance with chemical-specific SCGs	Meets chemical specific SCGs such as ground water standards	Yes 4 No ____	4 0
2. Compliance with action-specific SCGs	Meets SCGs such as technology standards for incineration or landfill	Yes 3 No ____	3 0
3. Compliance with location-specific SCGs	Meets location-specific SCGs such as Freshwater Wetlands Act	Yes 3 No ____	3 0
		TOTAL (maximum = 10)	10

ALTERNATIVE A: In-Situ SVE/Solidification

SITE NAME:
SITE NUMBER:

Table 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Maximum Score = 20)

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

ALTERNATIVE A: In-Situ SVE/Solidification

SITE NAME:
SITE NUMBER:

Table 5.4

SHORT-TERM EFFECTIVENESS
(Maximum Score = 10)

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 ____ No 4	0 4
	• Can the risk be easily controlled?	Yes ____ No ____	1 0
	• Does the mitigative effort to control risk impact the community life-style?	Yes ____ No ____	0 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 ____ No 4	0 4
	• Are the available mitigative measures reliable to minimize potential impacts?	Yes ____ No ____	3 0
	Subtotal (maximum = 4)		4
3. Time to implement the remedy.	• What is the required time to implement the remedy?	≤ 2yr. 1 > 2yr. ____	1 0
	• Required duration of the mitigative effort to control short-term risk.	≤ 2yr. 1 > 2yr. ____	1 0
	Subtotal (maximum = 2)		2
	TOTAL (maximum = 10)		10

ALTERNATIVE A: In-Situ SVE/Solidification

SITE NAME:
SITE NUMBER:

Table 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening			Score
1. On-site or off-site treatment or land disposal.	• On-site treatment*		3	3
	• Off-site treatment*			1
	• On-site or off-site land disposal			0
* treatment is defines as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes.	Subtotal (maximum = 3)			3
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	3
		No		0
	Subtotal (maximum = 3)			3
3. Lifetime of remedial actions.	• Expected lifetime or duration of effectiveness of the remedy.	25-30yr.		3
		20-25yr.		2
		15-20yr.		1
		< 15yr.		0
	Subtotal (maximum = 3)			0
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	3	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	0
		No		2
	iii) Is the treated residual toxic?	Yes		0
		No	1	1
	iv) Is the treated residual mobile?	Yes		0
		No	1	1
	Subtotal (maximum = 5)			5

Table 5.5
(continued)
LONG-TERM EFFECTIVENESS AND PERMANENCE
(Maximum Score = 15)

Analysis Factor		Basis for Evaluation During Preliminary Screening			Score
5. Adequacy and reliability of controls.	i)	Operation and maintenance required for a period of:	< 5yr.	1	1
			> 5yr.	______	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	1	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	2	2
			Moderate	______	1
			Extensive	______	0
		Subtotal (maximum = 4)			4
		TOTAL (maximum = 15)			15

Table 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Maximum Score = 15)

Analysis Factor		Basis for Evaluation During Preliminary Screening			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	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	2
	iii)	After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal		0
			On-site land disposal		1
			Off-site destruction or treatment		2
		If subtotal = 10, go to Factor 3. Subtotal (maximum = 10)			4
2. Reduction in mobility of hazardous waste. If Factor 2 is not applicable, go to Factor 3.	i)	Quality of Available Wastes Immobilized After Destruction/ Treatment	90-100%	2	2
			60-90%		1
			< 60%		0
	ii)	Method of Immobilization			
		• Reduced mobility by containment.			0
		• Reduced mobility by alternative treatment technologies.		0	0
		Subtotal (maximum = 5)			2

Table 5.6
(continued)
REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening		Score
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste	Completely irreversible	5	5
	Irreversible for most of the hazardous waste constituents.		3
	Irreversible for only some of the hazardous waste constituents.		2
	Reversible for most of the hazardous waste constituents.		0
	Subtotal (maximum = 5)		5
	TOTAL (maximum = 15)		11

ALTERNATIVE A: In-Situ SVE/Solidification

SITE NAME:
SITE NUMBER:

Table 5.7

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 uncertaintied in construction.	3	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	3
	ii)	Somewhat reliable in meeting the specified process efficiencies or performance goals.		2
c. Schedule of delays due to technical problems.	i)	Unlikely.	2	2
	ii)	Somewhat unlikely.		1
d. Need of undertaking additional remedial action, if necessary.	i)	No future remedial actions may be anticipated.	2	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.	1	1
	iii)	Extensive coordination is required.		0
		Subtotal (maximum = 2)		1

Table 5.7
(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 1 No ____	1 0
	ii)	Will more than one vendor be available to provide a competitive bid?	Yes 1 No ____	1 0
b. Availability	i)	Additional equipment and specialists may be available without significant delay.	Yes 1 No ____	1 0
		Subtotal (maximum = 3)		3
		TOTAL (maximum = 15)		14

Table 5.2

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

(Maximum Score = 10)

Analysis Factor	Basis for Evaluation During Preliminary Screening		Score
1. Compliance with chemical-specific SCGs	Meets chemical specific SCGs such as ground water standards	Yes 4 No ____	4 0
2. Compliance with action-specific SCGs	Meets SCGs such as technology standards for incineration or landfill	Yes 3 No ____	3 0
3. Compliance with location-specific SCGs	Meets location-specific SCGs such as Freshwater Wetlands Act	Yes 3 No ____	3 0
	TOTAL (maximum = 10)		10

Table 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Maximum Score = 20)

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

Table 5.4

SHORT-TERM EFFECTIVENESS
(Maximum Score = 10)

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 ____ No __4__	0 4
	• Can the risk be easily controlled?	Yes ____ No ____	1 0
	• Does the mitigative effort to control risk impact the community life-style?	Yes ____ No ____	0 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 ____ No __4__	0 4
	• Are the available mitigative measures reliable to minimize potential impacts?	Yes ____ No ____	3 0
	Subtotal (maximum = 4)		4
3. Time to implement the remedy.	• What is the required time to implement the remedy?	≤ 2yr. __1__ > 2yr. ____	1 0
	• Required duration of the mitigative effort to control short-term risk.	≤ 2yr. __1__ > 2yr. ____	1 0
	Subtotal (maximum = 2)		2
	TOTAL (maximum = 10)		10

Table 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening			Score
1. On-site or off-site treatment or land disposal.	• On-site treatment*		3	3
	• Off-site treatment*			1
	• On-site or off-site land disposal			0
* treatment is defines as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes.	Subtotal (maximum = 3)			3
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	3
		No		0
	Subtotal (maximum = 3)			3
3. Lifetime of remedial actions.	• Expected lifetime or duration of effectiveness of the remedy.	25-30yr.		3
		20-25yr.		2
		15-20yr.		1
		< 15yr.		0
	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	3	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	2	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

Table 5.5
(continued)
LONG-TERM EFFECTIVENESS AND PERMANENCE
(Maximum Score = 15)

Analysis Factor		Basis for Evaluation During Preliminary Screening			Score
5. Adequacy and reliability of controls.	i)	Operation and maintenance required for a period of:	< 5yr.	1	1
			> 5yr.		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	1	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	2	2
			Moderate		1
			Extensive		0
		Subtotal (maximum = 4)			**4**
		TOTAL (maximum = 15)			**15**

Table 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME

(Maximum Score = 15)

Analysis Factor		Basis for Evaluation During Preliminary Screening			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	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	0
			No	______	2
	iii)	After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal	0	0
			On-site land disposal	______	1
			Off-site destruction or treatment	______	2
		If subtotal = 10, go to Factor 3. Subtotal (maximum = 10)			7
2. Reduction in mobility of hazardous waste. If Factor 2 is not applicable, go to Factor 3.	i)	Quality of Available Wastes Immobilized After Destruction/ Treatment	90-100%	______	2
			60-90%	______	1
			< 60%	______	0
	ii)	Method of Immobilization			
		• Reduced mobility by containment.		______	0
		• Reduced mobility by alternative treatment technologies.		______	0
		Subtotal (maximum = 5)			–

Table 5.6
(continued)
REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening		Score
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste	Completely irreversible	5	5
	Irreversible for most of the hazardous waste constituents.	____	3
	Irreversible for only some of the hazardous waste constituents.	____	2
	Reversible for most of the hazardous waste constituents.	____	0
	Subtotal (maximum = 5)		5
	TOTAL (maximum = 15)		12

ALTERNATIVE B: In-Situ SVE/Soil Washing

SITE NAME:
SITE NUMBER:

Table 5.7

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 uncertaintied in construction.	______	3
	ii)	Somewhat difficult to construct. No uncertainties in construction.	2	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.	2	2
c. Schedule of delays due to technical problems.	i)	Unlikely.	______	2
	ii)	Somewhat unlikely.	1	1
d. Need of undertaking additional remedial action, if necessary.	i)	No future remedial actions may be anticipated.	2	2
	ii)	Some future remedial actions may be necessary.	______	1
		Subtotal (maximum = 10)		7
2. Administrative Feasibility				
a. Coordination with other agencies.	i)	Minimal coordination is required.	______	2
	ii)	Required coordination is normal.	1	1
	iii)	Extensive coordination is required.	______	0
		Subtotal (maximum = 2)		1

Table 5.7
(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 1 No ____	1 0
	ii)	Will more than one vendor be available to provide a competitive bid?	Yes 1 No ____	1 0
b. Availability	i)	Additional equipment and specialists may be available without significant delay.	Yes 1 No ____	1 0
		Subtotal (maximum = 3)		3
		TOTAL (maximum = 15)		11

ALTERNATIVE **D**: Thermal Desorption/Solidification

SITE NAME:
SITE NUMBER:

Table 5.2

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

(Maximum Score = 10)

Analysis Factor	Basis for Evaluation During Preliminary Screening		Score
1. Compliance with chemical-specific SCGs	Meets chemical specific SCGs such as ground water standards	Yes 4 No ____	4 0
2. Compliance with action-specific SCGs	Meets SCGs such as technology standards for incineration or landfill	Yes 3 No ____	3 0
3. Compliance with location-specific SCGs	Meets location-specific SCGs such as Freshwater Wetlands Act	Yes 3 No ____	3 0
	TOTAL (maximum = 10)		10

Table 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Maximum Score = 20)

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

Table 5.4

SHORT-TERM EFFECTIVENESS
(Maximum Score = 10)

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 ____	0 4
	• Can the risk be easily controlled?	Yes 1 No ____	1 0
	• Does the mitigative effort to control risk impact the community life-style?	Yes ____ No 2	0 2
	Subtotal (maximum = 4)		3
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 ____ No 4	0 4
	• Are the available mitigative measures reliable to minimize potential impacts?	Yes ____ No ____	3 0
	Subtotal (maximum = 4)		4
3. Time to implement the remedy.	• What is the required time to implement the remedy?	≤ 2yr. 1 > 2yr. ____	1 0
	• Required duration of the mitigative effort to control short-term risk.	≤ 2yr. 1 > 2yr. ____	1 0
	Subtotal (maximum = 2)		2
	TOTAL (maximum = 10)		9

Table 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening			Score
1. On-site or off-site treatment or land disposal.	• On-site treatment*		3	3
	• Off-site treatment*			1
	• On-site or off-site land disposal			0
* treatment is defines as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes.				
	Subtotal (maximum = 3)			3
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	3
		No		0
	Subtotal (maximum = 3)			3
3. Lifetime of remedial actions.	• Expected lifetime or duration of effectiveness of the remedy.	25-30yr.		3
		20-25yr.		2
		15-20yr.		1
		< 15yr.		0
	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	3	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	0
		No		2
	iii) Is the treated residual toxic?	Yes		0
		No	1	1
	iv) Is the treated residual mobile?	Yes		0
		No	1	1
	Subtotal (maximum = 5)			5

Table 5.5
(continued)
LONG-TERM EFFECTIVENESS AND PERMANENCE
(Maximum Score = 15)

Analysis Factor		Basis for Evaluation During Preliminary Screening			Score
5. Adequacy and reliability of controls.	i)	Operation and maintenance required for a period of:	< 5yr.	1	1
			> 5yr.	______	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	1	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	2	2
			Moderate	______	1
			Extensive	______	0
		Subtotal (maximum = 4)			**4**
		TOTAL (maximum = 15)			15

ALTERNATIVE D: Thermal Desorption/Solidification

SITE NAME:
SITE NUMBER:

Table 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME

(Maximum Score = 15)

Analysis Factor		Basis for Evaluation During Preliminary Screening			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	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	0
			No	____	2
	iii)	After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal	____	0
			On-site land disposal	____	1
			Off-site destruction or treatment	2	2
		If subtotal = 10, go to Factor 3. **Subtotal (maximum = 10)**			**4**
2. Reduction in mobility of hazardous waste. If Factor 2 is not applicable, go to Factor 3.	i)	Quality of Available Wastes Immobilized After Destruction/ Treatment	90-100%	2	2
			60-90%	____	1
			< 60%	____	0
	ii)	Method of Immobilization			
		• Reduced mobility by containment.		____	0
		• Reduced mobility by alternative treatment technologies.		0	0
		Subtotal (maximum = 5)			**2**

ALTERNATIVE D: Thermal Desoption/Stabilization

SITE NUMBER:

Table 5.6
(continued)
REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening		Score
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste	Completely irreversible	5	5
	Irreversible for most of the hazardous waste constituents.		3
	Irreversible for only some of the hazardous waste constituents.		2
	Reversible for most of the hazardous waste constituents.		0
	Subtotal (maximum = 5)		5
	TOTAL (maximum = 15)		11

ALTERNATIVE D: Thermal Desorption/Solidification

SITE NAME:
SITE NUMBER:

Table 5.7

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 uncertaintied in construction.	______	3
	ii)	Somewhat difficult to construct. No uncertainties in construction.	2	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.	2	2
c. Schedule of delays due to technical problems.	i)	Unlikely.	______	2
	ii)	Somewhat unlikely.	1	1
d. Need of undertaking additional remedial action, if necessary.	i)	No future remedial actions may be anticipated.	2	2
	ii)	Some future remedial actions may be necessary.	______	1
		Subtotal (maximum = 10)		7
2. Administrative Feasibility				
a. Coordination with other agencies.	i)	Minimal coordination is required.	______	2
	ii)	Required coordination is normal.	1	1
	iii)	Extensive coordination is required.	______	0
		Subtotal (maximum = 2)		1

Table 5.7
(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 1 No ___		1 0
	ii)	Will more than one vendor be available to provide a competitive bid?	Yes 1 No ___		1 0
b. Availability	i)	Additional equipment and specialists may be available without significant delay.	Yes 1 No ___		1 0
		Subtotal (maximum = 3)			3
		TOTAL (maximum = 15)			11

ALTERNATIVE F: Capping

SITE NAME:
SITE NUMBER:

Table 5.2

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

(Maximum Score = 10)

Analysis Factor	Basis for Evaluation During Preliminary Screening		Score
1. Compliance with chemical-specific SCGs	Meets chemical specific SCGs such as ground water standards	Yes 4 No ____	4 0
2. Compliance with action-specific SCGs	Meets SCGs such as technology standards for incineration or landfill	Yes 3 No ____	3 0
3. Compliance with location-specific SCGs	Meets location-specific SCGs such as Freshwater Wetlands Act	Yes 3 No ____	3 0
	TOTAL (maximum = 10)		10

(Based on no present contamination for ground water)

ALTERNATIVE F: Capping

SITE NAME:
SITE NUMBER:

Table 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Maximum Score = 20)

Analysis Factor	Basis for Evaluation During Preliminary Screening			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 0		0
	TOTAL (Maximum = 20)			0
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes 3		3
		No ______		0
	ii) Is the exposure to contaminants via ground water/surface water acceptable?	Yes 4		4
		No ______		0
	iii) Is the exposure to contaminants via sediments/soils acceptable?	Yes 3		3
		No ______		0
	Subtotal (maximum = 10)			10
3. Magnitude of residual public health risks after the remediation.	i) Health risk	≤ 1 in 1,000,000	5	5
	ii) Health risk	≤ 1 in 100,000	______	2
	Subtotal (maximum = 5)			5
4. Magnitude of residual environmental risks after the remediation.	i) Less than acceptable		5	5
	ii) Slightly greater than acceptable		______	3
	iii) Significant risk still exists		______	0
	Subtotal (maximum = 5)			5
	TOTAL (maximum = 20)			20

ALTERNATIVE F: Capping

SITE NAME:
SITE NUMBER:

Table 5.4

SHORT-TERM EFFECTIVENESS
(Maximum Score = 10)

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 ____ No 4	0 4
	• Can the risk be easily controlled?	Yes ____ No ____	1 0
	• Does the mitigative effort to control risk impact the community life-style?	Yes ____ No ____	0 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 ____ No 4	0 4
	• Are the available mitigative measures reliable to minimize potential impacts?	Yes ____ No ____	3 0
	Subtotal (maximum = 4)		4
3. Time to implement the remedy.	• What is the required time to implement the remedy?	≤ 2yr. 1 > 2yr. ____	1 0
	• Required duration of the mitigative effort to control short-term risk.	≤ 2yr. 1 > 2yr. ____	1 0
	Subtotal (maximum = 2)		2
	TOTAL (maximum = 10)		10

ALTERNATIVE F: Capping

SITE NAME:
SITE NUMBER:

Table 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening			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		0	0
* treatment is defines as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes.	Subtotal (maximum = 3)			0
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	0	0
	Subtotal (maximum = 3)			0
3. Lifetime of remedial actions.	• Expected lifetime or duration of effectiveness of the remedy.	25-30yr.	3	3
		20-25yr.	____	2
		15-20yr.	____	1
		< 15yr.	____	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	____	3
		≤ 25%	____	2
		25-50%	____	1
		≥ 50%	0	0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 5.)	Yes	____	0
		No	2	2
	iii) Is the treated residual toxic?	Yes	____	0
		No	____	1
	iv) Is the treated residual mobile?	Yes	____	0
		No	____	1
	Subtotal (maximum = 5)			2

Table 5.5
(continued)
LONG-TERM EFFECTIVENESS AND PERMANENCE
(Maximum Score = 15)

Analysis Factor		Basis for Evaluation During Preliminary Screening			Score
5. Adequacy and reliability of controls.	i)	Operation and maintenance required for a period of:	< 5yr.	______	1
			> 5yr.	0	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	0
			No	______	1
	iii)	Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident	1	1
			Somewhat to not confident	______	0
	iv)	Relative degree of long-term monitoring required (compare with other remedial alternatives).	Minimum	______	2
			Moderate	______	1
			Extensive	0	0
		Subtotal (maximum = 4)			1
		TOTAL (maximum = 15)			6

ALTERNATIVE F: Capping

SITE NAME:
SITE NUMBER:

Table 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Maximum Score = 15)

Analysis Factor		Basis for Evaluation During Preliminary Screening			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	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	2
	iii)	After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal	______	0
			On-site land disposal	______	1
			Off-site destruction or treatment	______	2
		If subtotal = 10, go to Factor 3.			
		Subtotal (maximum = 10)			2
2. Reduction in mobility of hazardous waste. If Factor 2 is not applicable, go to Factor 3.	i)	Quality of Available Wastes Immobilized After Destruction/ Treatment	90-100%	______	2
			60-90%	______	1
			< 60%	______	0
	ii)	Method of Immobilization			
		• Reduced mobility by containment.		0	0
		• Reduced mobility by alternative treatment technologies.		______	0
		Subtotal (maximum = 5)			0

Table 5.6
(continued)

REDUCTION OF TOXICITY, MOBILITY OR VOLUME

(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening		Score
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste	Completely irreversible	____	5
	Irreversible for most of the hazardous waste constituents.	____	3
	Irreversible for only some of the hazardous waste constituents.	____	2
	Reversible for most of the hazardous waste constituents.	0	0
	Subtotal (maximum = 5)		0
	TOTAL (maximum = 15)		2

ALTERNATIVE F: Capping

SITE NAME:
SITE NUMBER:

Table 5.7

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 uncertaintied in construction.	3	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.	2	2
c. Schedule of delays due to technical problems.	i)	Unlikely.	2	2
	ii)	Somewhat unlikely.		1
d. Need of undertaking additional remedial action, if necessary.	i)	No future remedial actions may be anticipated.		2
	ii)	Some future remedial actions may be necessary.	1	1
		Subtotal (maximum = 10)		8
2. Administrative Feasibility				
a. Coordination with other agencies.	i)	Minimal coordination is required.	2	2
	ii)	Required coordination is normal.		1
	iii)	Extensive coordination is required.		0
		Subtotal (maximum = 2)		2

ALTERNATIVE F: Capping

SITE NAME:
SITE NUMBER:

Table 5.7
(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 1 No ___	1 0
	ii)	Will more than one vendor be available to provide a competitive bid?	Yes 1 No ___	1 0
b. Availability	i)	Additional equipment and specialists may be available without significant delay.	Yes 1 No ___	1 0
		Subtotal (maximum = 3)		3
		TOTAL (maximum = 15)		13

ALTERNATIVE G: Off-Site Disposal

SITE NAME:
SITE NUMBER:

Table 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Maximum Score = 10)

Analysis Factor	Basis for Evaluation During Preliminary Screening		Score
1. Compliance with chemical-specific SCGs	Meets chemical specific SCGs such as ground water standards	Yes 4 No ____	4 0
2. Compliance with action-specific SCGs	Meets SCGs such as technology standards for incineration or landfill	Yes 3 No ____	3 0
3. Compliance with location-specific SCGs	Meets location-specific SCGs such as Freshwater Wetlands Act	Yes 3 No ____	3 0
	TOTAL (maximum = 10)		10

(Based on no present contamination for ground water)

Table 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

(Maximum Score = 20)

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

ALTERNATIVE G: Off-Site Disposal

SITE NAME:
SITE NUMBER:

Table 5.4

SHORT-TERM EFFECTIVENESS
(Maximum Score = 10)

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 ___	0 4
	• Can the risk be easily controlled?	Yes 1 No ___	1 0
	• Does the mitigative effort to control risk impact the community life-style?	Yes ___ No 2	0 2
	Subtotal (maximum = 4)		3
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 ___ No 4	0 4
	• Are the available mitigative measures reliable to minimize potential impacts?	Yes ___ No ___	3 0
	Subtotal (maximum = 4)		4
3. Time to implement the remedy.	• What is the required time to implement the remedy?	≤ 2yr. 1 > 2yr. ___	1 0
	• Required duration of the mitigative effort to control short-term risk.	≤ 2yr. 1 > 2yr. ___	1 0
	Subtotal (maximum = 2)		2
	TOTAL (maximum = 10)		9

SITE NAME:
SITE NUMBER:

Table 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening			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		0	0
* treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes.	Subtotal (maximum = 3)			0
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	0	0
	Subtotal (maximum = 3)			0
3. Lifetime of remedial actions.	• Expected lifetime or duration of effectiveness of the remedy.	25-30yr.	3	3
		20-25yr.	____	2
		15-20yr.	____	1
		< 15yr.	____	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	3	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	2	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

Table 5.5
(continued)

LONG-TERM EFFECTIVENESS AND PERMANENCE

(Maximum Score = 15)

Analysis Factor		Basis for Evaluation During Preliminary Screening			Score
5. Adequacy and reliability of controls.	i)	Operation and maintenance required for a period of:	< 5yr.	1	1
			> 5yr.		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	1	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	2	2
			Moderate		1
			Extensive		0
		Subtotal (maximum = 4)			**4**
		TOTAL (maximum = 15)			12

Table 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Maximum Score = 15)

Analysis Factor		Basis for Evaluation During Preliminary Screening			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	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	2
	iii)	After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal	0	0
			On-site land disposal	______	1
			Off-site destruction or treatment	______	2
		If subtotal = 10, go to Factor 3. Subtotal (maximum = 10)			2
2. Reduction in mobility of hazardous waste. If Factor 2 is not applicable, go to Factor 3.	i)	<u>Quality of Available Wastes Immobilized After Destruction/ Treatment</u>	90-100%	______	2
			60-90%	______	1
			< 60%	0	0
	ii)	<u>Method of Immobilization</u>			
		• Reduced mobility by containment.		______	0
		• Reduced mobility by alternative treatment technologies.		0	0
		Subtotal (maximum = 5)			0

Table 5.6
(continued)
REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening		Score
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste	Completely irreversible	____	5
	Irreversible for most of the hazardous waste constituents.	____	3
	Irreversible for only some of the hazardous waste constituents.	2	2
	Reversible for most of the hazardous waste constituents.	____	0
	Subtotal (maximum = 5)		2
	TOTAL (maximum = 15)		4

ALTERNATIVE G: Off-Site Disposal

SITE NAME:
SITE NUMBER:

Table 5.7

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 uncertaintied in construction.	3	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	3
	ii)	Somewhat reliable in meeting the specified process efficiencies or performance goals.		2
c. Schedule of delays due to technical problems.	i)	Unlikely.	2	2
	ii)	Somewhat unlikely.		1
d. Need of undertaking additional remedial action, if necessary.	i)	No future remedial actions may be anticipated.	2	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.	1	1
	iii)	Extensive coordination is required.		0
		Subtotal (maximum = 2)		1

ALTERNATIVE G: Off-Site Disposal

SITE NAME:
SITE NUMBER:

Table 5.7
(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 1 No ___	1 0
	ii)	Will more than one vendor be available to provide a competitive bid?	Yes 1 No ___	1 0
b. Availability	i)	Additional equipment and specialists may be available without significant delay.	Yes 1 No ___	1 0
		Subtotal (maximum = 3)		3
		TOTAL (maximum = 15)		14