COST AND PERFORMANCE REPORT

EXECUTIVE SUMMARY

This report presents cost and performance data for a soil vapor extraction (SVE) treatment system at the SMS Instruments Superfund site in Deer Park, New York. As a result of leaks in an underground storage tank at SMS, soil was contaminated with volatile and semivolatile organic compounds, including halogenated volatile organic compounds (VOCs). SMS was added to the National Priorities List in June 1986, and a ROD was signed in September 1989.

The SVE system was operated from May 1992 to October 1993, and was notable for using horizontal vapor extraction wells, a catalytic oxidation unit for control of off-gases, and a process control system which allowed for remote monitoring of system performance.

SMS Instruments operated as an overhauler of military aircraft components. Past waste disposal practices at the site included discharging untreated wastewater from degreasing and other refurbishing operations to an underground leaching pool. An investigation conducted in 1981 indicated that there was a leak from an underground storage tank used to store jet fuel at the site. The results of a Remedial Investigation completed in 1989 indicated soil contamination in the areas of the leaching pool and underground storage tank.

New York State Department of Environmental Conservation developed soil cleanup levels for nine volatile organic constituents and nine semivolatile organic constituents, ranging from 0.5 to 5.5 mg/kg. Additional criteria for assessing compliance with cleanup requirements were included in the monitoring plan developed for the site. Soil boring data collected in June 1993 indicated that all soil cleanup levels and criteria were met for this application.

The total cost for treatment activities at SMS was $450,521, including $182,700 for one year of monthly operations and maintenance. This corresponds to $360/cubic yard of soil treated (estimated at 1,250 cubic yards of soil).

SITE INFORMATION

Identifying Information

SMS Instruments Superfund Site
Deer Park, NY
Operable Unit #1
CERCLIS # NYD001533165
ROD Date: September 29, 1989

Treatment Application

Type of Action: Remedial
Treatability Study Associated with Application? Yes *(see discussion on cleanup goals)*
EPA SITE Program Test Associated with Application? No
Operating Period: May 1992 to October 1993
Quantity of Soil Treated During Application: 1,250 cubic yards (estimate provided in the Record of Decision)

Background [1]

Historical Activity that Generated Contamination at the Site: Overhauling of military aircraft components

Corresponding SIC Code(s): 3728 (Aircraft parts and auxiliary equipment, not elsewhere classified)

Waste Management Practice that Contributed to Contamination: Underground Storage Tank

Site History: The 1.5-acre SMS Instruments site is located in a light industrial and residential area of Deer Park, Suffolk County, New York, as shown on Figure 1. Since 1967, the

SITE INFORMATION (CONT.)

Background [1] (cont.)

site was used for overhauling of military aircraft components. Past waste disposal practices at the site included the discharge of untreated wastewater from degreasing and other refurbishing operations to an underground leaching pool. In 1980, the site owner removed 800 gallons of contaminated wastewater from the pool, sealed all drain pipes leading to the pool, and subsequently filled the pool with sand.

In 1981, Suffolk County required the site owner to leak test a 6,000-gallon underground storage tank (UST) used to store jet fuel. The test results indicated that the tank leaked. The tank was emptied, and subsequently excavated and removed from the site.

A remedial investigation (RI), which was completed at the site in 1989, indicated that the site was contaminated with volatile and semivolatile organic compounds, including halogenated compounds. Several areas at the site where VOCs concentrations exceeded 1,000 ug/kg were identified.

From May 1992 to October 1993, a SVE system was used to treat 1,250 cubic yards of contaminated soil. A pump and treat program using air stripping for remediating contaminated groundwater at the site was begun after the SVE treatment process was completed, and was ongoing at the time of this report.

Regulatory Context: A Record of Decision (ROD) was signed in 1989 which addressed soil and groundwater contamination at the site. The ROD addressed control measures for specific source areas at the site including the leaching pool, former UST area, and spill areas where wastes were formerly stored in drums. Figure 2 shows the location of these three source areas at the site. In addition, the ROD specified that suspected sources of upgradient contamination be investigated. The ROD refers to the leaching pool and former UST area as Operable Unit #1, and to the suspected upgradient

Figure 1. Site Location

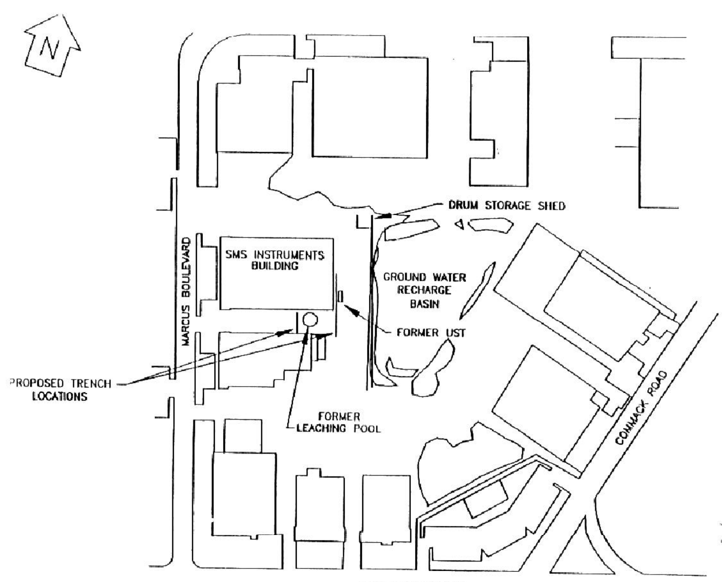

Figure 2. Site Layout [2]

SITE INFORMATION (CONT.)

Background [1] (cont.)

contamination sources as Operable Unit #2. This report focuses on the soil contamination in Operable Unit #1.

Remedy Selection: The ROD identified five alternatives for remediating contaminated soil at this site:

- No action;
- Source removal and off-site disposal;
- Source removal and off-site incineration;
- Low temperature soil stripping; and
- In situ steam stripping.

The ROD specified in situ steam stripping as the most appropriate remedy for contaminated soil at this site based on the results of an analysis of the condition of the soil at the site (homogeneity, high porosity, and absence of clays). [1]

The ROD also required that a treatability study be conducted during the design stage of the remedy to assess whether the selected technology could be used effectively. [1] The results of the treatability study indicated that steam stripping did not appear to be feasible, and soil vapor extraction was recommended as an appropriate treatment technology for this application. [2]

Site Logistics/Contacts

Site Management: Fund Lead

Oversight: EPA

Remedial Project Manager:
Abram Miko Fayon
U.S. EPA Region 2
Jacob K. Javits Federal Building
New York, NY 10278-0012
(212) 264-4706

Prime Contractor:
George Asimenios
CDM Federal Programs Corporation
(EPA ARCS contractor)
111 Fulton Street
Suite 710
New York, NY 10038
(212) 393-9634

Subcontractor:
Bill Ballance
Four Seasons Environmental, Inc.
3107 South Elm - Eugene Street
P.O. Box 16590
Greensboro, NC 27416-0590
(919) 273-2718

MATRIX DESCRIPTION

Matrix Identification

Type of Matrix Processed Through the Treatment System:
Soil (in situ)

Contaminant Characterization

Primary Contaminant Groups: Volatile and semivolatile organic compounds

Twenty-nine soil borings were collected and analyzed for volatile and semivolatile organic compounds during the remedial investigation and remedial design. The results from these soil borings for selected constituents are shown in Table 1. Figure 3 shows the location of areas of contamination where VOCs exceed 1,000 µg/kg and 100 µg/kg, and shows the potential extent of migration of semi-volatile compounds in unsaturated soils at the site. Figure 4 illustrates the con-taminant plume where VOCs exceed 1,000 µg/kg at the water table. [2]

MATRIX DESCRIPTION (CONT.)

Table 1. Subsurface Soil Contamination Levels at SMS Instruments Site [2]

Constituent	Source Area Soil	
	Highest Concentration (mg/kg)	Average Concentration (mg/kg)
Volatiles		
trans-1,2-Dichloroethene	1.5	0.456
2-Butanone	10	5
2-Hexanone	160	105
Tetrachloroethene	6.5	1.1
Toluene	60	58
Trichloroethene	0.051	0.020
Total Xylenes	1200	306
Ethylbenzene	150	50
Chlorobenzene	340	133
Semivolatiles		
1,4-Dichlorobenzene	330	68.9
1,3-Dichlorobenzene	64	15
1,2-Dichlorobenzene	1800	297
Naphthalene	16	6.4
1,2,4-Trichlorobenzene	51	13.5
2-Methylnaphthalene	20	8.4
Phenols	4.7	0.83
2-Methylphenol	2.8	2.8
2,4-Dimethylphenol	4.6	3.55
Bis(2-ethylhexyl)phthalate	7.4	2.18

Matrix Characteristics Affecting Treatment Cost or Performance [2]

The major matrix characteristics affecting cost or performance for this technology, and the values measured for each are presented in Table 2.

Table 2. Matrix Characteristics [2]

Parameter	Value	Measurement Method
Soil Classification	Well-sorted sands to silty sands with fine gravel	Soil borings
Clay Content	3.14 to 27.89%	Percent finer than #200 sieve
Moisture Content	1.34 to 11.63%	ASTM D2216
Soil Moisture Content (% Dry Wt.)	0.5 to 14.3%	ASTM D2216
Permeability	0.00227 to 0.00333 cm/sec	Wykeham Farrance Shelby tube permeameter
Porosity	30 to 41%	Ratio: volume of voids/total specimen volume
Total Organic Carbon	1,000 to 7,500 mg/kg	EPA method SW 846-9060
Nonaqueous Phase Liquids	Not identified	—

MATRIX DESCRIPTION (CONT.)

Matrix Characteristics Affecting Treatment Cost or Performance [2] (cont.)

In addition to those identified in Table 2, the following matrix characteristics were measured:

Average dry bulk density:	1.55-1.83 gm/cm^3
Hydraulic conductivity:	268 ft/day (per RI slug test)
Depth to groundwater:	16-24 feet below grade
Average annual temperature of unsaturated soil:	40-70°F
Specific gravity:	2.239-2.934
Cation exchange capacity:	66.4-153.0 milliequivalents per 100 grams (as NO_4^+)

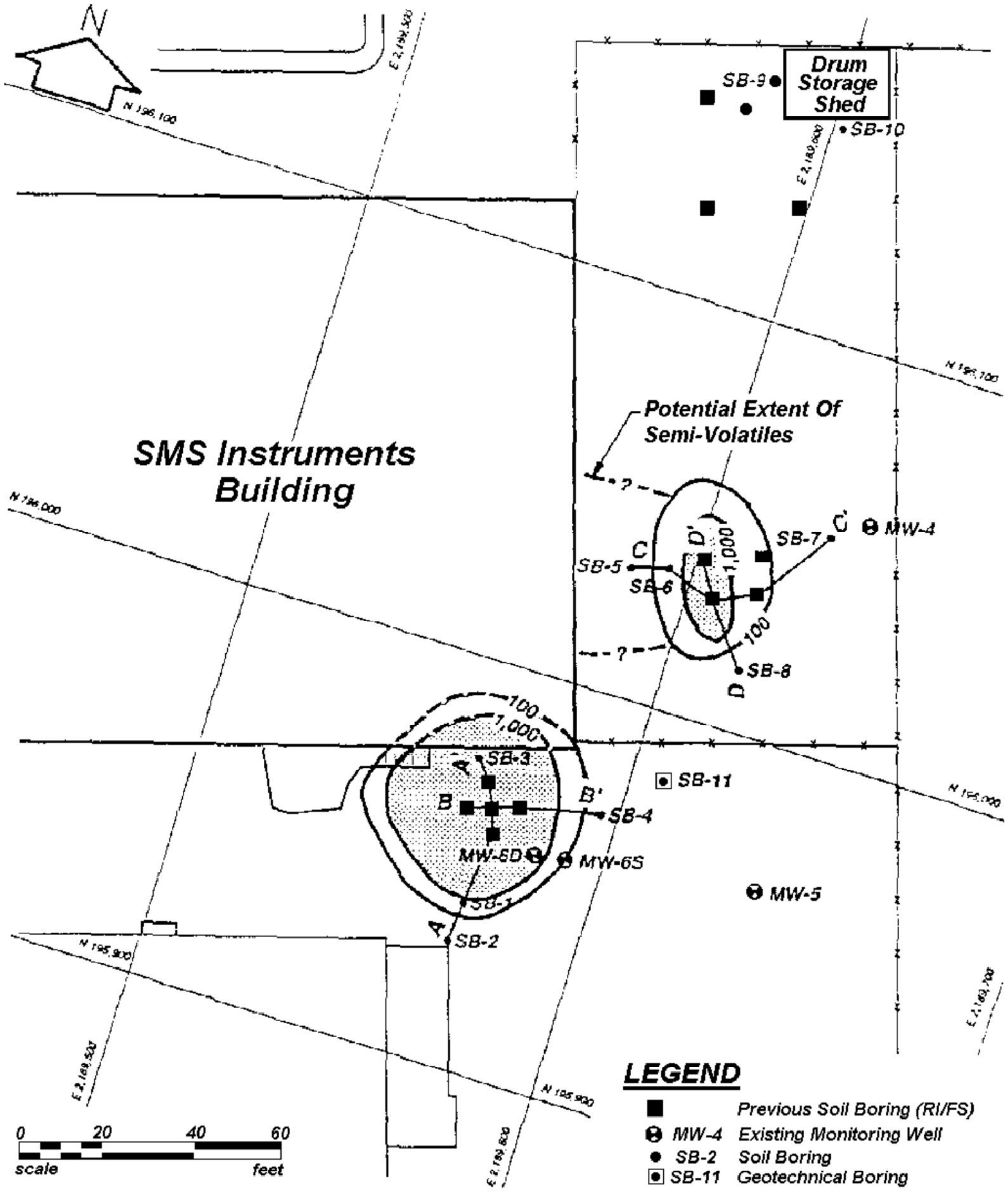

Figure 3. VOC's in Unsaturated Soils [2]

MATRIX DESCRIPTION (CONT.)

Matrix Characteristics Affecting Treatment Cost or Performance [2] (cont.)

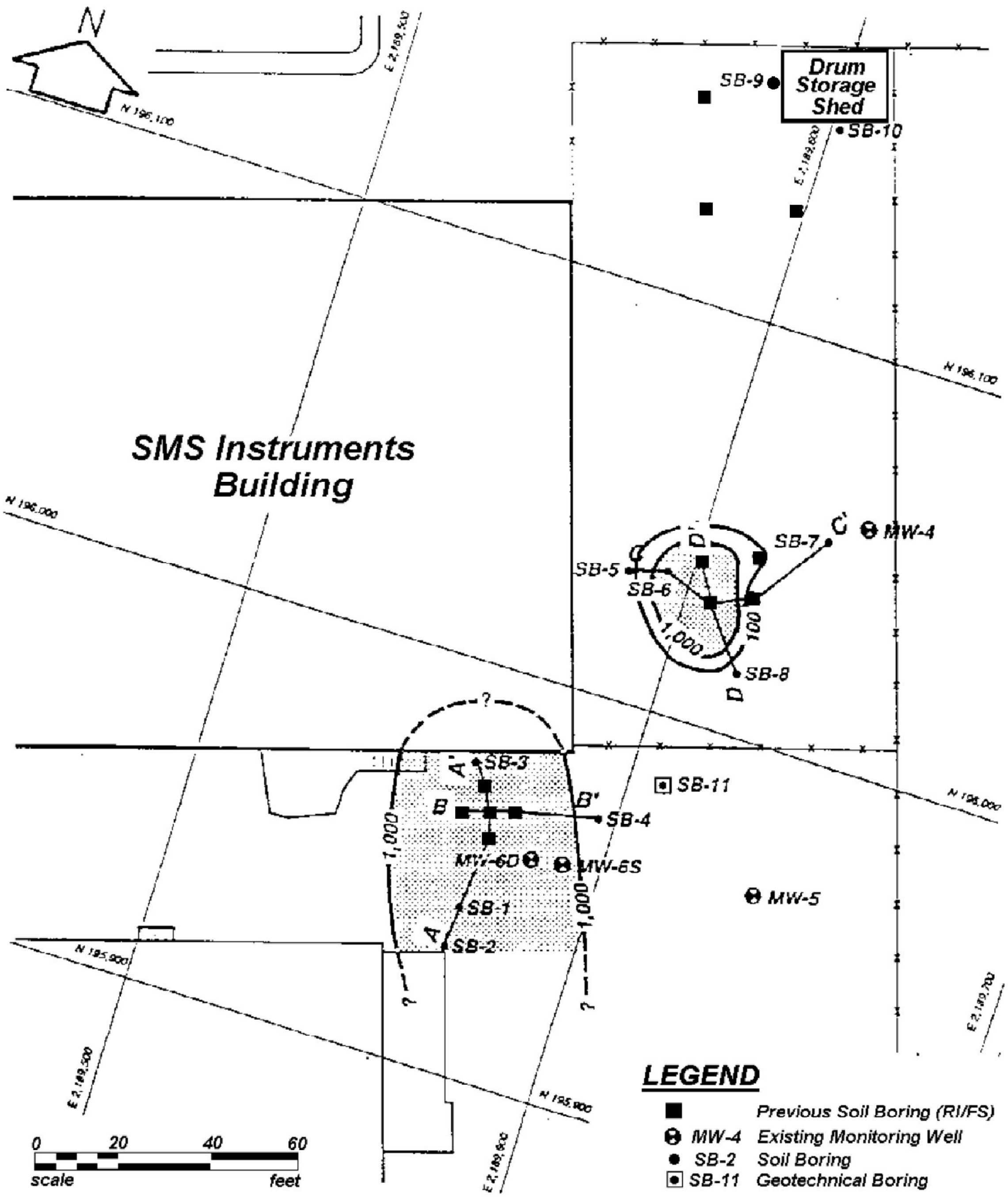

Figure 4. VOC's in Soil at the Water Table [2]

MATRIX DESCRIPTION (CONT.)

Site Geology/Stratigraphy [2]

The RI identified two stratigraphic layers within the contaminated areas of the SMS site. The first layer, 0 to 16 feet below grade, consists of well-sorted sands with little to no fines. The second layer, 16 to 26 feet below grade, consists of silty sands with fine gravel.

The site is located in the recharge zone of the Magothy aquifer, a sole-source aquifer for Long Island, and a groundwater recharge basin is located directly adjacent to the site.

TREATMENT SYSTEM DESCRIPTION

Primary Treatment Technology Type

Soil Vapor Extraction

Supplemental Treatment Technology Types

Post-Treatment of Vapors: Catalytic Incinerator, Scrubber

Soil Vapor Extraction Treatment System Description and Operation

The SVE system used at the SMS site included two horizontal vapor extraction wells, a vacuum pump, a catalytic oxidizer, and an acid gas scrubber. The horizontal wells were installed in 2-feet wide, 75-feet long, 15-feet deep trenches located adjacent to the contaminated areas, as shown in Figure 5. Slotted high density polyethylene pipe was installed in the trenches approximately 8 feet below grade. Figure 6 shows a cross-section of an interceptor trench. The slotted pipes were vented to a control building containing a 300-cubic feet per minute vacuum pump. [5, 6, and 32]

Extracted vapors were treated using a catalytic oxidation unit and an acid gas scrubber. The catalytic oxidation unit, Global Chloro-Cat VTM, is a pre-fabricated modular device containing a 325,000 Btu/hr burner and a reactor using a proprietary catalyst developed by Allied Signal Corporation. Contaminant-laden vapors were heated to approximately 725°F prior to entering the reactor. The acid gas scrubber unit, Global Chloro-Cat Tailgas Scrubber, is also a pre-fabricated modular device and uses a 15% by weight solution of NaOH to neutralize HCl vapors exiting the catalytic oxidizer unit. [7]

Process Control: The SVE system used at SMS included an extensive process control system to allow remote monitoring and system oversight. This system monitored numerous parameters at the site and provided the information over a telephone line

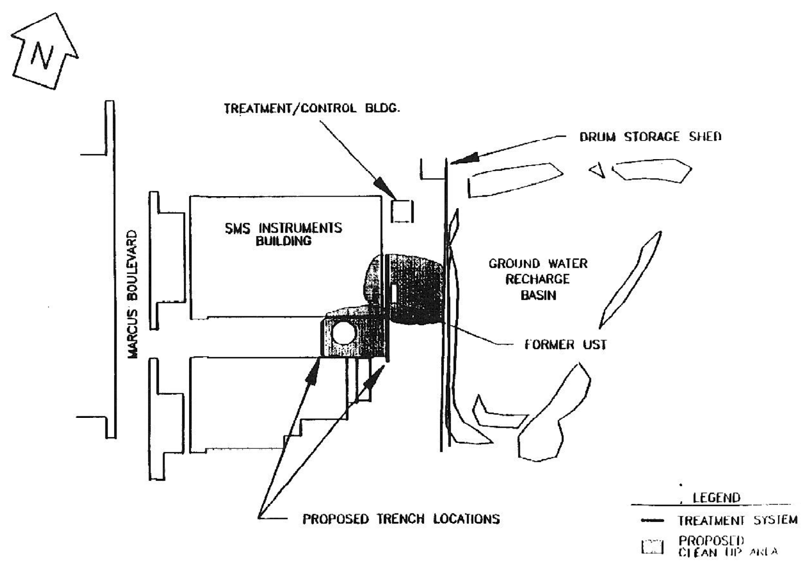

Figure 5. Trench Locations [5]

TREATMENT SYSTEM DESCRIPTION (CONT.)

Soil Vapor Extraction Treatment System Description and Operation (cont.)

hook-up to the vendor's home office in another state. The system provided alarm messages to the vendor's remote office location when parameters deviated from programmed ranges, and shut down the treatment system, as appropriate. Parameters monitored during this application included barometric pressure, vacuum in several manometer clusters, vacuum in both trenches, air velocity in both trenches, vacuum at the blower inlet and outlet, velocity at the blower outlet, vapor stream temperatures and hydrocarbon content (measured using a photoionization detector), motor current, blower oil pressure and temperature, and sump water level. The parameters monitored for the catalytic oxidation unit included reactor inlet and outlet temperature, system air velocity, percent of lower explosive limit, blower motor current, and gas train status. Acid gas scrubber parameters monitored included pH of the sump water, water level in the sump, circulating pump motor current, and water flow to the stripping tower. [7]

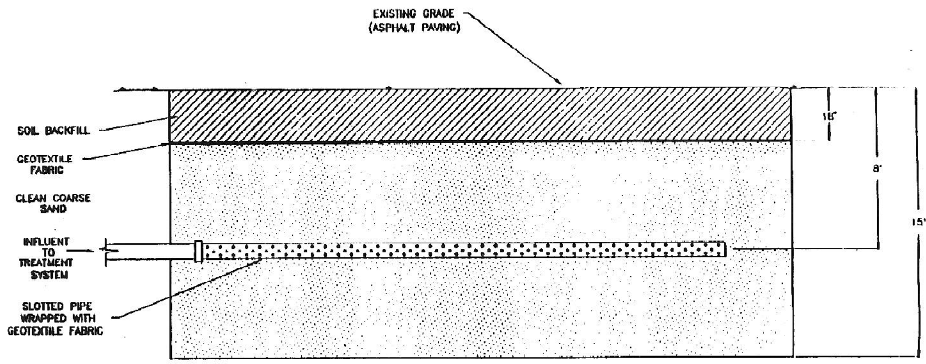

Figure 6. Cross-Section of an Interceptor Trench [5]

System Operation: System operation began in May 1992 and concluded in October 1993. The system was operated to alternate extraction from the two wells on a weekly basis. [32]

System operation was interrupted several times and for a variety of reasons during this period, including power failures, wind-related damage, and lightning. System operation was shut down for approximately 30 percent of the operating period. A summary of these interruptions is presented in Appendix A. [9-27].

Health and Safety: Field operations at SMS were conducted in accordance with a written health and safety plan as per OSHA standard 29 CFR 1910.120. [5]

Operating Parameters Affecting Treatment Cost or Performance

The major operating parameters affecting cost or performance for this technology and the values measured for each during this application are presented in Table 3. [9-27]

Table 3. Operating Parameters [9-27]

Parameter	Value	Measurement Method
Air Flow Rate	57.11 to 444.67 cfm	Not available
Vacuum	378.17 to 405.70 water column inches absolute	Not available

TREATMENT SYSTEM DESCRIPTION (CONT.)

Timeline

The timeline for this application is presented in Table 4.

Table 4. Timeline [1, 3, 9-27]

Start Date	End Date	Activity
June 10, 1986	.	Listed on National Priorities List
September 29, 1989	.	Record of Decision signed
May 1992	October 18, 1993	SVE system operation
June 15, 1993	June 17, 1993	Soil sampling conducted to determine if cleanup levels achieved
November 3, 1993	November 10, 1993	SVE system pulsed operation test

TREATMENT SYSTEM PERFORMANCE

Cleanup Goals/Standards [2]

As shown in Table 5, cleanup levels for nine volatile and nine semivolatile contaminants in soil at SMS were developed by the New York State Department of Environmental Conservation. In addition, air emissions from the SVE system were required to meet New York State ambient air guidelines for toxic air contaminants.

Table 5. Soil Cleanup Levels and Ambient Air Guideline Concentrations [2]

Contaminant	Soil Cleanup Level (mg/kg)	Ambient Air Guideline Concentration (µg/m^3)
Volatiles		
trans-1,2-Dichloroethene	0.5	Not identified
2-Butanone	0.5	Not identified
2-Hexanone	0.7	Not identified
Tetrachloroethene	1.5	1,116
Toluene	1.5	7,500
Trichloroethene	1.0	900
Total Xylene	1.2	1,450
Ethylbenzene	5.5	1,450
Chlorobenzene	1.0	1,167
Semivolatiles		
1,4-Dichlorobenzene	1.0	Not identified
1,3-Dichlorobenzene	1.5	Not identified
1,2-Dichlorobenzene	1.0	1,000
Naphthalene	1.0	167
1,2,4-Trichlorobenzene	2.3	133
2-Methylnaphthalene	2.0	Not identified
Phenol	0.33	10
2-Methylphenol	2.6	Not identified
Bis(2-ethylhexyl)phthalate	4.5	Not identified

Additional soil cleanup criteria specified in the monitoring plan included:

- No more than 20% of soil samples analyzed were to exceed individual contaminant cleanup level, and exceedances were limited to a total of four target contaminants per sample; and
- Cleanup levels for soil samples analyzed were not to be greater than twice the soil cleanup levels.

Requirements for measuring performance included using samples from seven soil borings at the site (PB1-PB7). Two samples were required from each boring; one sample collected from 1 foot above the water table (approximately 16-18 feet below grade) and one sample collected at approximately 12-14 feet below grade. All soil samples were required to be analyzed for volatile and semivolatile organic compounds in accordance with EPA's Contract Laboratory Program (CLP) statement of work, multimedia, multiconcentration (SOW-3/90).

TREATMENT SYSTEM PERFORMANCE (CONT.)

Additional Information on Goals

The ROD for this site specified treatment of contaminated soil at SMS by SVE, and required that a treatability study be completed during the design stage of the application to assess the potential effectiveness of this technology. In addition, the ROD indicated that VOC contaminants were to be used as indicators and that appropriate cleanup levels would be identified during the treatability study. [1]

Treatment Performance Data

Soil sampling was conducted at SMS on June 15 and 17, 1993 to assess whether the cleanup levels had been achieved for soil at the site. Seven soil borings were completed in the leaching pool and underground storage tank source areas, and are referred to as performance borings (PB). Continuous split-spoon samples were collected to completion of the boring (approximately 17 feet below grade). Two samples were collected from each boring; one from an interval 15-17 feet below grade, and one from an interval 10-14 feet below grade (showing the highest levels measured by a field screening procedure). The results for the two samples collected from each of the seven soil borings at SMS are presented in Table 6. [3 and 28]

Table 6. Results for Soil Borings at SMS [3]

	Boring No.	PB1		PB2		PB3		PB4		PB5		PB6		PB7	
	Sample No.	4	5	3	5	4	5	3	5	4	5	3	4	3	5
	Interval (ft)	12-14	15-17	10-12	15-17	12-14	15-17	10-12	15-17	12-14	15-17	12-14	15-17	10-12	15-17
Constituent	Cleanup Level (µg/kg)	(µg/kg)													
Volatiles															
Acetone	N/A	340 DE	10 U	71 U	30 U	81	24	1400 D	90	5 U	4400 D	62	4000 D	38 U	6 U
2-Butanone	500	13	10 U	10 U	4 J	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U	10 U	10 U
2-Hexanone	700	10 U	10 U	10 U	10 U	15	10 U	10 U	10 U	10 U	11 U	10 U	10 U	10 U	10 U
Toluene	1,500	10 U	10 U	10 U	10 U	10 U	6 J	10 U	10 U	10 U	11 U	10 U	10 U	10 U	10 U
Chlorobenzene	1,600	10 U	10 U	10 U	10 J	10 U	230 E	10 U	10 U	10 U	11 U	10 U	10 U	10 U	10 U
Ethylbenzene	5,500	10 U	10 U	10 U	10 U	10 U	92	10 U	10 U	10 U	11 U	10 U	10 U	10 U	10 U
Xylenes (total)	1,200	10 U	5 J	200	14	10 U	1000 DJ	10 U	10 U	10 U	11 U	10 U	10 U	10 U	10 U
Semivolatiles															
1,3-Dichlorobenzene	1,500	670 U	340 U	76 J	340 U	330 U	340 U	340 U	340 U	340 U	350 U	680 U	680 U	340 U	340 U
1,4-Dichlorobenzene	1,000	670 U	340 U	340 U	340 U	330 U	120 J	340 U	340 U	340 U	38 J	680 U	680 U	340 U	340 U
1,2-Dichlorobenzene	1,000	250 J	340 U	340 U	340 U	190 J	1,400	340 U	340 U	340 U	350 U	680 U	680 U	340 U	340 U
2-Methylphenol	2,600	110 J	510	1,500	390	170 J	200 J	340 U	340 U	340 U	350 U	680 U	680 U	340 U	340 U
4-Methylphenol	N/A	100 J	180 J	340	150 J	49 J	53 J	340 U	340 U	340 U	350 U	680 U	680 U	340 U	340 U
Isophorone	N/A	670 U	340 U	340 U	340 U	330 U	340 U	340 U	340 U	340 U	520	680 U	680 U	340 U	340 U
2,4-Dimethylphenol	N/A	150 J	120 J	310 J	340 U	35 J	75 J	340 U	340 U	340 U	350 U	680 U	680 U	340 U	340 U
1,2,4-Trichlorobenzene	2,300	670 U	90 J	710	220 J	290 J	870	340 U	340 U	340 U	350U	680 U	680 U	340 U	340 U
Naphthalene	1,000	670 U	340 U	100 J	340 U	64 J	280 J	340 U	340 U	340 U	350 U	680U	680 U	340 U	340 U
2-Methylnaphthalene	2,000	670 U	150 J	430	160 J	110 J	590	340 U	340 U	340 U	850	680U	680 U	340 U	340 U
Acenaphthene	N/A	70 J	340 U	340 U	340 U	330 U	340 U	340 U	340 U	340 U	350 U	680 U	680 U	340 U	340 U
Dibenzofuran	N/A	670 U	340 U	340 U	340 U	330 U	340 U	340 U	340 U	340 U	85 J	680 U	680 U	340 U	340 U
Fluorene	N/A	120 J	65 J	340 U	120 J	330 U	340 U	340 U	340 U	340 U	120 J	680 U	680 U	340 U	340 U
N-Nitrosodiphenylamine (1)	N/A	670 U	340 U	340 U	340 U	330 U	340 U	340 U	340U	340 U	61 J	680 U	89 J	340 U	340 U
Phenanthrene	N/A	770	60 J	66 J	310 J	330 U	340 U	340 U	340 U	340 U	70 J	680 U	680 U	340 U	340 U

NOTES:
a)"U" denotes that constituent was not detected. The value shown is the detection limit.
b)"J" denotes that the result is estimated.
c)"D" denotes that the result was quantified at a secondary dilution factor.
d)"E" denotes that the result is estimated and exceeded the instrument calibration range.
N/A - Not applicable. No cleanup level specified for this constituent.

TREATMENT SYSTEM PERFORMANCE (CONT.)

Table 6. Results for Soil Borings at SMS (cont.)

Constituent	Boring No.	PB1		PB2		PB3		PB4		PB5		PB6		PB7	
	Sample No.	4	5	3	5	4	5	3	5	4	5	3	4	3	5
	Interval (ft)	12-14	15-17	10-12	15-17	12-14	15-17	10-12	15-17	12-14	15-17	12-14	15-17	10-12	15-17
	Cleanup Level (µg/kg)	(µg/kg)													
Semivolatiles (cont.)															
Anthracene	N/A	240 J	340 U	340 U	59 J	330 U	340 U	340 U	340 U	340 U	350 U	680 U	680 U	340 U	340 U
Carbazole	N/A	94 J	340 U	340 U	46 J	330 U	340 U	340 U	340 U	340 U	350 U	680 U	680 U	340 U	340 U
Di-n-butylphthalate	N/A	83 J	61 J	150 J	90 J	49 J	78 J	340 U	340 U	340 U	44 J	680 U	680 U	340 U	340 U
Fluoranthene	N/A	930	440	500	750	110 J	71 J	340 U	340 U	340 U	41 J	680 U	680 U	340 U	340 U
Pyrene	N/A	440 J	340 U	39 J	180 J	330 U	340 U	340 U	340 U	340 U	54 J	680 U	680 U	340 U	340 U
Butylbenzylphthalate	N/A	670 U	190 J	140 J	250 J	330 U	340 U	340 U	340 U	340 U	350 U	680 U	680 U	340 U	340 U
Benzo(a)anthracene	N/A	230 J	340 U	340 U	110 J	330 U	340 U	340 U	340 U	340 U	350 U	680 U	680 U	340 U	340 U
Chrysene	N/A	320 J	340 U	340 U	160 J	330 U	340 U	340 U	340 U	340 U	350 U	680 U	680 U	340 U	340 U
Bis(2-ethylhexyl) phthalate	4,500	1,300	2,100	13000 D	3300 D	1000	1200	49 J	39 J	340 U	600	79 J	140 J	340 U	340 U
Di-n-octylphthalate	N/A	670 U	340 U	110 J	37 J	330 U	340 U	340 U	340 U	340 U	350 U	680 U	680 U	340 U	340 U
Benzo(b)fluoranthene	N/A	150 J	340 U	340 U	82 J	330 U	340 U	340 U	340 U	340 U	350 U	680 U	680 U	340 U	340 U
Benzo(k)fluoranthene	N/A	140 J	340 U	340 U	52 J	330 U	340 U	340 U	340 U	340 U	350 U	680 U	680 U	340 U	340 U

NOTES:
a)"U" denotes that constituent was not detected. The value shown is the detection limit.
b)"J" denotes that the result is estimated.
c)"D" denotes that the result was quantified at a secondary dilution factor.
d)"E" denotes that the result is estimated and exceeded the instrument calibration range.
N/A - Not applicable. No cleanup level specified for this constituent.

Performance Data Assessment

The data in Table 6 show that the cleanup levels for soil were achieved in twelve of the fourteen samples collected. As shown in Table 6, only two contaminants exceeded the soil cleanup levels at this site; 1,2-dichlorobenzene at 1,400 µg/kg in boring PB3-5 and bis(2-ethylhexyl) phthalate (BEHP) at 13,000 µg/kg in boring PB2-3. Since only two of the fourteen samples (14%) exceeded the cleanup levels, and only one individual target contaminant exceeded the cleanup levels, the criterion was met for fewer than 20% of soil samples analyzed exceeding individual contaminant cleanup levels, and exceedances being fewer than four target contaminants per sample.

BEHP was measured at a concentration more than twice its soil cleanup level in one soil sample. The EPA RPM indicated that this result may be an anomaly, because the concentration measured in the treated soil was greater than the maximum concentration for BEHP previously measured during the remedial investigation at the site (7.4 mg/kg). [28]

The ambient air guideline concentrations were met during SVE system operation.

Performance Data Completeness

Available soil boring data allow for comparison of performance of the SVE system with respect to cleanup levels.

Performance Data Quality

Soil boring data were analyzed in accordance with EPA's CLP statement of work, multimedia, multiconcentration (SOW-3/90). [2]

TREATMENT SYSTEM COST

Procurement Process

The SVE system was procured by CDM Federal Programs Corporation, an EPA ARCS contractor, on the basis of a cost proposal submitted by Four Seasons Industrial Services, Inc. (now Four Seasons Environmental, Inc.) in September 1991. This project was contracted on a fixed price basis, with provisions in the contract for financial penalties if certain performance criteria were not achieved within a specified time period (i.e., 730 days after construction of the SVE system). The remediation was completed within approximately 540 days. [4]

Treatment System Cost

The treatment system costs are provided in Table 7. As shown in Table 7, $450,521 of costs were incurred by the treatment subcontractor for this application. This total treatment cost corresponds to $360 per cubic yard of soil treated for 1250 cubic yards of soil treated. This calculated cost per unit of media treated is based on an estimate of the amount of contaminated soil as shown in the ROD for this site. The actual quantity of contaminated media is not available for comparison purposes.

Table 7 shows the costs for 14 specific items included in this total value. No additional information on the specific items included in these cost elements (e.g., for subcontract completion), or on whether these values represent actual or estimated costs, is available at this time. Because the specific items included in these cost elements is not available, a cost breakdown using the interagency Work Breakdown Structure (WBS) is not provided in this report.

In addition, costs incurred by the EPA ARCs contractor for this application are not available at this time. The specific activities completed by the ARCs contractor in this application are not described in the available references.

Cost Data Quality

Treatment system cost information was provided by the ARCs contractor for the costs incurred by the treatment subcontractor. No information is available on other costs incurred in this application (e.g., those incurred by the EPA ARCs contractor).

Table 7. Cost Breakdown for Treatment Subcontractor [31]

Cost Element	Cost ($)
Complete SVE System Design	16,240
Health and Safety Plan	4,060
Mobilization	2,030
Install SVE System Wells	12,180
SVE System Construction	60,900
Final O&M Manual	4,060
Monthly O&M (one year)	182,700
Demobilization	2,030
Subcontract Completion	121,800
Monthly O&M (Option Period)	14,700
Completion of Contract Option	6,300
Relocation of Drums (mod. no. 4)	400
Relocation of Drums (mod. no. 5)	1,668
Incentive (mod. no. 11)	21,453
Subcontract Total	450,521

TREATMENT SYSTEM COST (CONT.)

Vendor Input

The treatment vendor indicated that reduced air monitoring, and use of a flame ionization detector (FID) instead of a photoionization detector (PID) for measuring hydrocarbons in extracted vapors would reduce the cost for future applications of SVE. The moisture in the vapors tended to interfere with the readings on the PID, and the vendor indicated that an FID would not be as sensitive to moisture as a PID.

OBSERVATIONS AND LESSONS LEARNED

Cost Observations and Lessons Learned

- The total treatment system cost for the SVE treatment system used at SMS was $450,521, including $182,700 for monthly operations and maintenance costs for one year.
- The cleanup levels specified for the SVE system were achieved within the 730 day deadline imposed by the contract for the treatment vendor, and no financial penalties were incurred.
- The total treatment cost corresponds to $360/cubic yard of soil treated (estimated as 1,250 cubic yards of soil). This was a relatively small project which limited economies-of-scale for treatment activities.
- The treatment vendor indicated that the costs associated with instrumentation were greater than anticipated because the amount of maintenance required for the system had been underestimated.

Performance Observations and Lessons Learned

- The soil cleanup levels and criteria for SMS were achieved for 17 of the 18 specified constituents within approximately 400 days after SVE operation began.
- The ambient air guideline concentrations were met during SVE system operations.
- A process control system was used in this application that allowed for remote monitoring of system performance.
- The EPA RPM indicated that the BEHP concentration, measured at a level more than twice the cleanup level, may have been an anomaly. The BEHP concentration measured in the treated soil was greater than the maximum concentration for BEHP previously measured during the remedial investigation at the site.

Other Observations and Lessons Learned

- The ductwork used to convey an acidic air stream from the catalytic oxidation unit to the offgas scrubber corroded often due to a high salt content and required replacement several times during SVE system operation.
- SVE system operation was interrupted several times and for a variety of reasons, including power failures, wind-related damage, and lightning.

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Analysis Preparation

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APPENDIX A — SYSTEM OPERATION INTERRUPTIONS

System Operation Interruptions [9-27]

Month and Year	Interruption Period	Reason for Interruption
May 1992	Weeks 1 and 4	Not known
June 1992	6/10/92	Power failure caused controller to lose RAM function and backup battery did not function properly
August 1992	8/8/92 to 8/31/92	Foaming condition in acid gas scrubber and lightning hit
September 1992	9/8/92 to 9/11/92	Gas leak
	9/14/92 to 9/24/92	Water leak in transition duct between catalytic oxidizer and acid gas scrubber
October 1992	10/10/92 to 10/23/92	Corrosion leaks in transition duct
November 1992	11/3/92	Instrument calibration
	11/6/92	Repairs including vacuum blower oil change
	11/9/92	Power surge
	11/18/92 to 11/22/92	Corrosion leaks in transition duct
	11/24/92	Cleaning of flame arrestor
December 1992	12/10/92	Replacement of signal transmitter
	12/11/92 to 12/12/92	Repair of damage from high winds (scaffolding blown down and broke water line to acid gas scrubber)
	12/17/92 to 12/22/92	Repair of solenoid valve
	12/23/92 to 12/31/92	Replacement of pump and repair of damage from wind storm, which blew a section of roof off the SMS building onto the vacuum blower building
January 1993	1/1/93 to 1/2/93	Adjustments to NaOH feed system
February 1993	2/1/93 to 2/4/93	Replacement of valve in acid gas scrubber
	2/13/93 to 2/14/93	Adjustment of vacuum blower alarm
March 1993	3/5/93 to 3/6/93	Power interruption
	3/13/93 to 3/16/93	Power interruption (snow storm)
	3/30/93	Vacuum blower shut down
April 1993	4/1/93 to 4/30/93	Repair of transition duct
May 1993	5/1/93 to 5/14/93	Completion of repair of transition duct
	5/19/93 to 5/20/93	Loose connection to power supply
June 1993	6/9/93 to 6/12/93	Vacuum blower shut down
	6/16/93 to 6/17/93	Soil sampling
	6/22/93 to 6/26/93	Maintenance of acid gas scrubber
July 1993	7/3/93 to 7/5/93	Power spike
	7/16/93 to 7/17/93	Power failure
	7/23/93 to 7/31/93	Leakage from the acid gas scrubber
August 1993	8/1/93 to 8/14/93	Leakage from the acid gas scrubber
	8/15/93	Power failure
	8/28/93 to 8/31/93	Failure of an electronic component
September 1993	9/1/93 to 9/2/93	Failure of an electronic component
	9/10/93 to 9/11/93	Power failure
	9/16/93 to 9/25/93	Not known
October 1993	10/2/93	Low water flow in acid gas scrubber

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COST AND PERFORMANCE REPORT

Soil Vapor Extraction
at the
SMS Instruments Superfund Site,
Deer Park, New York

Prepared By:

U.S. Environmental Protection Agency
Office of Solid Waste and Emergency Response
Technology Innovation Office

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NOTICE

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