COST AND PERFORMANCE REPORT

EXECUTIVE SUMMARY

This report presents cost and performance data for a thermal desorption treatment application at the Pristine, Inc. Superfund Site, located in Reading, Ohio. Pristine, Inc. performed liquid waste disposal operations at the site from 1974 to 1981 and operated as a sulfuric acid manufacturing facility prior to 1974. As a result of spills and on-site disposal of wastes, soils at the Pristine site became contaminated with volatile and semivolatile organics, polynuclear aromatic hydrocarbons (PAHs), pesticides, and inorganic metals. The soils also contained high levels of elemental sulfur (greater than 2%).

SoilTech's 10 ton/hr mobile Anaerobic Thermal Processor (ATP) system was used for treating contaminated soil at the Pristine site. The ATP system included a feed system, the ATP unit (rotary kiln thermal desorber), a vapor recovery system, a flue gas treatment system, and a tailings handling system. Wastewater from the vapor recovery system was treated in an on-site wastewater treatment system.

The ATP system was operated at the site from November 1, 1993 until March 4, 1994 and was used to treat approximately 12,800 tons of contaminated soil. The ATP System treated contaminants in soil to levels below the cleanup goals. Levels of six of the 11 target constituents were reduced to concentrations at or below the reported detection limits. All stack gas air emission performance standards were met in this application. Average throughput was approximately 6.5 tons/hr, and average on-line availability was approximately 62 percent, in this application. This application was notable for treating soil with a wide range of pH and moisture conditions. Treated soil was backfilled on site.

No information on treatment system cost was available at the time of this report.

SITE IDENTIFYING INFORMATION

Identifying Information

Pristine, Inc. Superfund Site
Reading, Ohio
CERCLIS #: OHD076773712
ROD Date: 30 March 1990

Treatment Application

Type of Action: Remedial
Treatability Study Associated With Application? No
EPA SITE Program Test Associated With Application? No
Period of Operation: November 1993 to March 1994
Quantity of Material Treated During Application: Approximately 12,800 tons of soil

Background

Historical Activity that Generated Contamination at the Site: Liquid waste storage, disposal, and treatment operations

Corresponding SIC Code: 4953 W - Waste Management; Refuse Systems (Waste Processing Facility, miscellaneous)

Waste Management Practice that Contributed to Contamination: Storage - Drums/ Containers; Waste Treatment Plant

Site History: Pristine, Inc., a former liquid waste disposal facility that operated from 1974 to 1981, is located on a 3-acre site in Reading, Ohio, as shown in Figure 1. Prior to 1974, the Pristine site was the location of a sulfuric acid manufacturing facility. Between

SITE INFORMATION (CONT.)

Background (cont.)

Figure 1. Site Location [1]

1974 and 1981, the Pristine facility accepted a variety of bulk and drummed liquid waste products, including acids, solvents, pesticides, and PCBs. The types of wastes stored at Pristine are shown in Table 1. These wastes were treated by acid neutralization or incineration, and disposed on site. In December 1977, the Ohio Environmental Protection Agency modified Pristine's operating permit to require that Pristine reduce the amount of waste maintained at the site to the equivalent of no more than 2,000 drums. [1, 2, and 3]

In 1979, an on-site inspection of Pristine's facilities by the Ohio EPA found 13 bulk storage tanks that each contained from 500 to 10,000 gallons of liquid waste material and as many as 10,000 drums on site. As a result of state enforcement actions, which cited Pristine's failure to comply with the terms of its waste incinerator operating permit and violations of water pollution control regulations, Pristine, Inc. ceased disposal activities at the site in 1981. Samples taken on and near the Pristine site during Remedial Investigation/Feasibility Study (RI/FS) indicated that soils and sediment at the site were contaminated with volatile organic compounds (VOCs), semivolatile organic compounds, including polynuclear aromatic hydrocarbons (PAHs), pesticides, compounds, and inorganic metals. [1,2]

Regulatory Context: A Record of Decision (ROD) was signed in December 1987 and amended in 1990. An Explanation of Significant Differences (ESD) amended the 1990 ROD and specified thermal desorption to remediate site soils. Thermal desorption was selected based on its ability to remove PAHs and pesticides from the site soil. [4,5,6]

Site Logistics/Contacts

Site Management: PRP Lead

Oversight: EPA

Remedial Project Manager:
Mr. Tom Alcamo
USEPA Region 5
230 South Dearborn Street
Chicago, Illinois 60604
(312) 886-7278

Vendor:
Mr. Thomas J. Froman
Project Engineer
Canonie Environmental Services Corp. (prime contractor)
800 Canonie Drive
Porter, IN 46304
(219) 926-8651

Mr. Joseph H. Hutton
SoilTech ATP Systems, Inc. (subcontractor)
800 Canonie Drive
Porter, IN 46304
(219) 926-8651

SITE INFORMATION (CONT.)

Background (cont.)

Table 1. Types of Wastes Stored at Pristine [3]

Mlxed paint sludges	Sodium
Acid-contaminated soil	Adipoyl chloride
Neutralized acid sludge	Kepone
DDT and other pesticides	Acetomethoxane (originally listed as dioxin)
Contaminated soap, cosmetics, corn syrup, and fatty acids	Inorganic peroxides
Dimethyl sulfate	Tetrahydrofuran
Hydrazine	Amines
Flammable solvents	Biological waste
Cyanide wastes	Pharmaceutical waste
Chlorinated solvent sludge	Freons
Sulfuric and nitric acid	Adhesives
PCB-contaminated solvents	Mercaptans
Ink solvent	Alcohols
Neutralized acid	Cadmium and plating waste
PCB-contaminated soybean oil	Phenolic plastics and resins
Sulfuric acid sludge	Phosphorus
Chrome wastes	Picric acid
Scrubber process wastes	Laboratory packs

MATRIX DESCRIPTION

Matrix Identification

Type of Matrix processed through the treatment system:

Soil (ex situ), sediment (ex situ)

Contaminant Characterization

Primary contaminant groups:

Volatiles, semivolatiles (primarily polynuclear aromatic hydrocarbons), pesticides, metals, and sulfur.

To characterize soils for thermal desorption, composite samples were collected from twelve separate areas across the Pristine site. Concentrations of volatile organics ranged from non-detect to 140 parts per billion (ppb), semivolatile organics ranged from non-detect to 130 ppm, lead ranged from 26 parts per million (ppm) to 1,100 ppm, and 4,4'-DDT ranged from 110 ppb to 8,200 ppb. Samples analyzed for PCBs were all non-detect. One composite sample was collected from the area near the former waste incinerator and analyzed for dioxins and furans. Laboratory analytical results for this sample indicated that concentrations of furans ranged from 26.7 parts per trillion to 722 parts per trillion, and concentrations dioxins ranged from 3.0 parts per trillion to 792 parts per trillion. [9]

The soil was also determined to contain sulfur in excess of 2% by weight. [20]

MATRIX DESCRIPTION (CONT.)

Contaminant Characterization (cont.)

Table 2 presents the concentrations of 17 contaminants in the untreated soil that was fed to the desorber during the three-day proof-of-process test. [16, 20]

Table 2. Feed Soil Concentrations [16,20]

Constituent	Number of Samples	Minimum Concentration (µg/kg)	Maximum Concentration (µg/kg)
Benzo(a)anthracene	3	530 J	1,100
Benzo(a)pyrene	3	420 J	750
Benzo(b)fluoranthene	3	980	1,900
Benzo(k)fluoranthene	3	290 J	440
Chrysene	3	790	890
Dibenzo(a,h)anthracene	3	ND (380)	ND (770)
Indeno(1,2,3-cd)pyrene	3	290 J	370 J
Aldrin	3	ND (460)	ND (2,300)
4,4'-DDT	3	3,200	4,800
Dieldrin	3	160 J	ND (2,300)
2,3,7,8-TCDD (equivalent)	4	9.93 E-04	1.06 E-02
Benzene	3	ND (6)	ND (6)
Chloroform	3	3 J	ND (6)
1,2-Dichloroethane	3	5 J	8
1,1-Dichloroethene	3	ND (6)	ND (6)
Tetrachloroethene	3	11	70
Trichloroethene	3	ND (6)	6

J - Result is an estimated value below the reporting limit.
ND - Not detected (detection limit shown in parentheses).

Matrix Characteristics Affecting Treatment Cost or Performance

Table 3 presents the major matrix characteristics affecting cost or performance for this application.

Table 3. Matrix Characteristics [9, 20]

Parameter	Value	Measurement Procedure
Soil Classification	Silty clays with some sand	Not available
Clay Content and/or Particle Size Distribution	Not available	.
Bulk Density	53-104 lbs/ft³	Not available
Lower Explosive Limit	Not available	.
Moisture Content	15-20%	Not available
pH	1-2 for some feed soils	Not available
Oil and Grease or Total Petroleum Hydrocarbons	Not available	.

TREATMENT SYSTEM DESCRIPTION

Primary Treatment Technology

Thermal desorption

Supplemental Treatment Technology

Post-treatment (air) - cyclone, quench, baghouse, carbon adsorption, condenser, and gas-oil-water separators.

Post-treatment (water) - oil/water separation (using a gravity separator, a coalescing plate system, an oleophilic membrane packing, and a dissolved air flotation system), hydrogen peroxide oxidation, sand filtration, and activated carbon filtration.

SoilTech ATP Thermal Desorption System Description and Operation

System Description

The SoilTech Anaerobic Thermal Processor, shown in Figure 2, is a mobile treatment system consisting of six main process units, including a soil pretreatment system, a feed system, an anaerobic thermal processor unit, a vapor recovery system, a flue gas treatment system, a tailings handling system, and a wastewater treatment system. [14, 17, 20]

The feed system consists of two feed hoppers and a conveyor belt. One feed hopper contains the contaminated soil and the other contains clean sand. The sand is fed to the ATP unit during system startup and shutdown periods, and acts as a heat carrier. [14, 18]

The ATP unit is a rotary kiln which contains four separate internal zones separated using proprietary sand seals. As shown in Figure 3, these include the preheat, retort, combustion, and cooling zones. The feed enters the preheat zone where it is heated to approximately 450°F and mixed, vaporizing water, volatile organics, and some semivolatile organics. The solids then enter the retort zone where they are heated to a target temperature range of 950 to 1,200°F, causing vaporization of heavy oils and some thermal cracking of hydrocarbons, resulting in the formation of coked solids and decontaminated solids. The solids from the retort zone then enter the combustion zone where coked solids are combusted. A portion of the decontaminated solids are recycled to the retort zone via a recycle channel. The recycling of these solids helps to maintain an elevated temperature in the retort zone. The decontaminated solids remaining in the combustion zone enter the cooling zone where they are cooled to a specified exit temperature. [14, 18]

The vapor recovery system consists of two parallel systems. One system condenses water and vapors from the preheat zone of the ATP unit and consists of a cyclone, a condenser, and a gas-oil-water separator. The other system condenses water and vapors from the retort zone and consists of two cyclones, a scrubber, a fractionator, a condenser, and a gas-oil-water separator. Condensed water from the vapor recovery system is treated in an on-site wastewater treatment system which consists of the following processes:

- Oil/water separation (using a gravity separator, a coalescing plate system, an oleophilic membrane packing, and a dissolved air flotation system);
- Hydrogen peroxide oxidation;
- Sand filtration; and
- Carbon adsorption.

The flue gas treatment system consists of a cyclone with fines conveyor, flue gas quencher chamber, baghouse with dust conveyor, acid gas scrubber, and activated carbon unit. This system removes particulates and trace hydrocarbons from the flue gas exiting the combustion zone of the ATP. Fines from the baghouse and cyclone are mixed with the treated solids exiting the ATP unit. The treated flue gas is released to the atmosphere. [14, 18]

TREATMENT SYSTEM DESCRIPTION (CONT.)

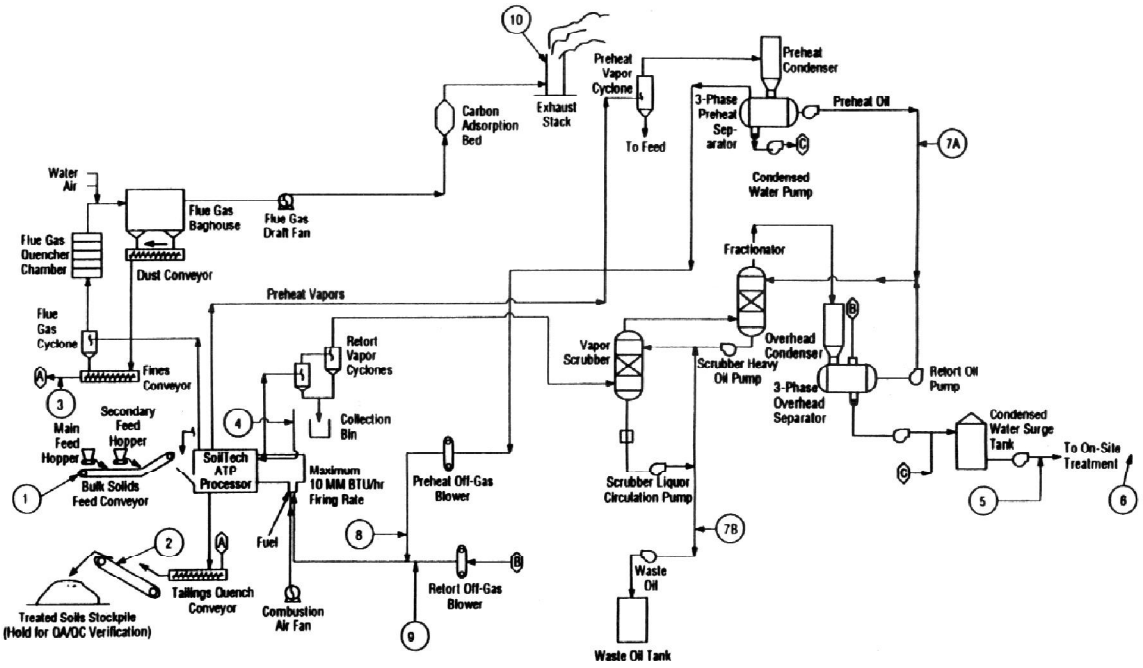

Figure 2. ATP Schematic [19]

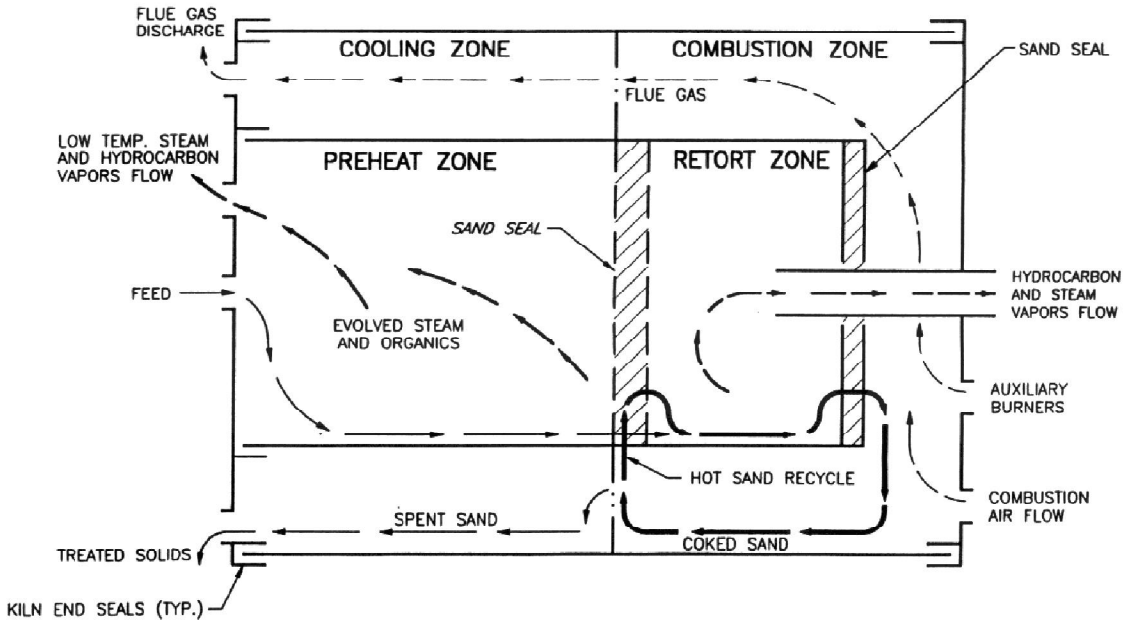

Figure 3. Simplified Sectional Diagram Showing the Four Internal Zones [14]

TREATMENT SYSTEM DESCRIPTION (CONT.)

SoilTech ATP Thermal Desorption System Description and Operation (cont.)

The tailings (treated solids) handling system is used to cool and remove treated solids from the ATP. The treated solids exiting the ATP are quenched with process and scrubber water and transported to storage piles using belt and screw conveyors. [14, 18]

Treated soil was backfilled on site. The soil was placed in trenches that were used for a soil vapor extraction system. The vendor stated that this area will be capped. [21, 22]

The primary innovative features of this ATP unit are the four internal zones and the use of proprietary sand seals at each end of the retort zone which are designed to maintain an oxygen-free environment in the retort zone. The oxygen-free environment in the retort zone helps to prevent the oxidation of hydrocarbons and coke. [14, 18]

System Operation

SoilTech conducted a proof-of-process performance test prior to full-scale operation to demonstrate compliance with soil treatment cleanup goals and stack gas emission performance standards. Four test runs (sampling windows) were completed during the proof-of-process test. [20]

Sulfur dioxide (SO_2) control was a particular concern in this application because of concerns with SO_2 emissions and the impact of SO_2 on corrosion of process equipment and on the pH of aqueous condensate streams. Several SO_2 control methods were used during the proof-of-process and full-scale operations, including lime (calcium oxide) addition, caustic solution, desorption, recovery of elemental sulfur under anaerobic conditions, and wet scrubbing of ATP flue gasses. [20]

During full-scale operation of the ATP system, 12,839 tons of soil and sediment were treated. Average throughput was approximately 6.5 tons/hr, and average on-line availability was approximately 62 percent. The wastewater from this system was treated and discharged to a sanitary sewer. [17,20]

Operating Parameters Affecting Treatment Cost or Performance [14,20]

Table 4 lists the major operating parameters affecting cost or performance for this technology. Values measured for these parameters during the proof-of-process period are included in this table. Automatic waste feed shutoff controls were used for key operating parameters, including retort and combustion zone temperatures and preheat, retort, and combustion zone pressures.

The data collected during the proof-of-process period indicated that the ATP system met all established performance criteria for flue gas stack emissions and for treated soil. Based on these results, EPA approved the continued operation of the ATP system at these target operating conditions.

Table 4. Operating Parameters [14, 20]

Parameter	Value	Measurement Procedure
Preheat and Retort Zone Residence Time	Approximately 5 minutes	Engineering design calculations
Preheat Zone Temperature	411.9-446.1°F	Thermocouples in preheat zone
Retort Zone Temperature	1,009.9-1,034.1°F	Thermocouples in retort zone
Combustion Zone Temperature	1,386.0-1,412.0°F	Thermocouples in combustion zone
Cooling Zone Temperature	623.8-688.8°F	Thermocouples in cooling zone
System Throughput	7.84-10 tons/hr	Weight of untreated solids measured using a truck scale
Preheat Zone Pressure	-0.10 inches water column	Pressure to electrical transducer
Retort Zone Pressure	-0.12 inches water column	Pressure to electrical transducer
Combustion Zone Pressure	-0.08 inches water column	Pressure to electrical transducer
Stack Gas Exit Temperature	135°F	Thermocouples in stack
Stack Gas Flow Rate	8,200 acfm @ 450°F	Orifice Plate Flowmeter

TREATMENT SYSTEM DESCRIPTION (CONT.)

Timeline

The timeline for this application is presented in Table 5.

Table 5. Timeline [4, 5, 14]

Start Date	End Date	Activity
12/82	—	Pristine added to National Priorites List
—	'87	RI/FS conducted
12/87	—	ROD signed
3/90	—	ROD amended
11/93	3/94	Thermal desorption completed
11/93	11/93	Three day proof-of-process test conducted

TREATMENT SYSTEM PERFORMANCE

Cleanup Goals/Standards

An Explanation of Significant Differences (ESD), which amended the 1990 ROD, identified the cleanup goals shown in Table 6 for treatment of on-site soils and sediments at the site.

Table 6. Cleanup Goals [6]

Constituent	Cleanup Goal (µg/kg)
Total Carcinogenic PAHs*	1,000
Aldrin	15
DDT	487
Dieldrin	6
2,3,7,8-TCDD (Equivalent)**	0.990
Benzene	116
Chloroform	2,043
1,2-Dichloroethane	19
1,1-Dichloroethane	285
Tetrachloroethane	3,244
Trichloroethane	175

**Total Carcinogenic PAHs are defined as the total of benzo(a)anthracene, benz(a)pyrene, benz(b)fluoranthene, benz(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene.*
***Cleanup goal for 2,3,7,8-TCDD (Equivalent) taken from Treated Soil Analytical Results. [16]*

While the ROD and ESD did not specify stack gas emission standards, standards for stack gas emissions were established for the proof-of-process period during project planning. Table 7 lists performance standards for stack gas emissions. In addition, a Destruction and Removal Efficiency (DRE) of 99.99% was required to be demonstrated for PAHs and pesticides in this application. [20]

TREATMENT SYSTEM PERFORMANCE (CONT.)

Cleanup Goals/Standards (cont.)

Table 7. Proof-of-Process Tests Stack Gas Emissions Performance Standards [20]

Parameter	Performance Standard
Particulates	0.015 grains per dry standard cubic foot (gr/dscf) corrected to 7% oxygen
Opacity	≤20%
Total Dioxin and Furan Emissions	<30 nanograms (ng)/dscm @ 7% O_2
Hydrogen Chloride	≤4 lbs/hr
Total Hydrocarbons (THC)	_<20 ppm corrected to 7% O_2
Sulfur Dioxide	16.6 gm/sec

Treatment Performance Data [16, 20]

Table 8 summarizes the results of the analysis of treated soil from 40 of the 44 piles. Data on the minimum and maximum constituent concentrations are presented; data on analysis by soil pile is included in Appendix A. Sampling was performed between November 1, 1993 and March 4, 1994. No data were reported for four of the piles (nos. 34-37).

Table 8. Treatment Performance Data [16]

Contituent	Number Soil Piles Analyzed	Cleanup Goal (µg/kg)	Minimum Concentration (µg/kg)	Maximum Concentration (µg/kg)
Benzo(a)anthracene	40	ND (370)	ND (370)	ND (400)
Benzo(a)pyrene	40	ND (370)	ND (370)	ND (400)
Benzo(b)fluroanthene	40	ND (370)	ND (370)	ND (400)
Benzo(k)fluroanthene	40	ND (370)	ND (370)	ND (400)
Chrysene	40	ND (370)	ND (370)	ND (400)
Dibenzo(a,h)anthracene	40	ND (370)	ND (370)	ND (400)
Indeno(1,2,3-cd)pyrene	40	ND (370)	ND (370)	ND (400)
Total Carcinogenic PAHs	40	1000	ND	ND
Aldrin	40	15	ND (4.3)	ND (4.9)
4,4'-DDT	40	487	ND (8.6)	9.6
Dieldrin	40	6	ND (4.0)	4.8
2,3,7,8-TCDD (equivalent)	40	0.99	0.000028	0.0123
Benzene	40	116	ND (5)	9
Chloroform	40	2043	ND (5)	9
1,2-Dichloroethane	40	19	ND (5)	ND (6)
1,1-Dichloroethane	40	285	ND (5)	ND (6)
Tetrachloroethane	40	3244	ND (5)	ND (6)
Trichloroethane	40	175	ND (5)	ND (6)

ND - Not detected (detection limit shown in parentheses).

TREATMENT SYSTEM PERFORMANCE (CONT.)

Treatment Performance Data (cont.)

Performance standards and analytical results for selected parameters in stack gas emissions during the proof-of-process tests as presented in Table 9. Air modelling using the ICST-2 model, was conducted to assess ground level concentrations of specific metals and other compounds.

Table 9. Stack Gas Emissions Results from Proof-of-Process Tests [20].

Parameter	Performance	Analytical Results
Particulates	0.015 grains per dry standard cubic foot (gr/dscf) corrected to 7% oxygen	<0.00078 gr/dscf @ 7% O_2
Opacity	≤20%	≤20%
Total Dioxin and Furan Emission	<30 nanograms (ng)/dscm @ 7% O_2	0.26 ng/dscm @7% O_2 (window no.1); 2,3,7,8-TCDD equivalent = 0.013 ng/dscm @ 7% O_2
Hydrogen Chloride	≤4 lbs/hr	0.00851 – 0.0144 lbs/hr
Total Hydrocarbons (THC)	<20 ppm corrected to 7% O_2	5.6 – 8.8 ppm (occasional spikes over 20 ppm*)
Sulfer Dioxide	16.6 gm/sec	<1 gm/sec

**Waste feed to the ATP was discontinued when THC concentrations exceeded 20 ppm. THC spikes (above 20 ppm) were attributed by the vendor to burner malfunction causing uncombusted propane fuel to be emitted from the stack*

To assess compliance with the 99.99% DRE for PAHs and pesticides during the proof-of-process period, surrogate organic compounds were added to the feed soil in window numbers 2, 3, and 4 of the proof-of-process test. 1,2,3-Trichlorobenzene was used as a surrogate to represent PAHs, and chloromethylbenzene (benzyl chloride) was used as a surrogate for pesticides. The results of the testing showed a 99.99% (four-nines) DRE for 1,2,3-trichlorobenzene in windows 2 and 3 (six-nines in window 4) and 99.999% (five-nines) DRE for benzyl chloride in windows 2, 3, and 4.

Performance Data Assessment

A review of the treatment performance data in Table 8 indicates that the cleanup goals for all constituents were met for the 40 piles of treated soil that were analyzed. The performance data show that the technology removed six of the 11 targeted constituents to levels at or below the detection limit. Only 4,4'-DDT, dieldrin, 2,3,7,8-TCDD (equivalent), benzene, and chloroform remained in the treated soil above the detection limit, at maximum concentration levels of 4.8 to 9.6 µg/kg.

For the seven PAH constituents analyzed, this technology was effective in removing these constituents to the reported detection limit (400 µg/kg).

A review of the stack gas emissions sampling results, presented in Table 9, show that during the proof-of-process tests, all stack gas emissions performance standards were met. Occasional THC spikes were measured at levels greater than the performance standard of 20 ppm. The vendor attributed these THC spikes to burner malfunction which caused uncombusted propane fuel to be emitted from the stack.

TREATMENT SYSTEM PERFORMANCE (CONT.)

Performance Data Completeness

Treatment performance data are available for assessing the concentrations of individual constituents in 40 of 44 soil piles treated, and for assessing the concentrations in feed soil and stack gas air emissions from the proof-of-process test.

Performance Data Quality

Project specifications were prepared for this application by Conestoga-Rovers Associates (CRA). The remedial action was monitored by CRA for the PRPs.

Soil samples were analyzed using SW-846 Methods 8270, 8080, 8290, and 8240. No exceptions to the QA/QC objectives were noted by the vendor for this application.

TREATMENT SYSTEM COST

Procurement Process

The PRPs contracted with Canonie Environmental Services Corp. to thermally treat soil and sediment at this site. Canonie contracted with SoilTech to perform the thermal treatment portion of the project. Conestoga-Rovers Associates was selected by the PRPs to monitor the remedial action. [20] No additional information is available on the competitive nature of the procurement process.

Treatment System Cost

No information was available on treatment system cost at the time of this report's preparation.

Vendor Input

According to the treatment vendor, in general, the costs for treatment using the SoilTech ATP system vary depending on the character of the waste material, with treatment costs ranging from $150 to $250 per ton for a 10 ton/hr ATP system. The factors identified by the vendor that affect costs include:

- Moisture content of feed material;
- Particle size;
- Hydrocarbon content;
- Material handling characteristics; and
- Chemical characteristics.

Vendor estimates for mobilization and demobilization costs for a 10-ton per hour system range from $700,000 to $1.5 million. [17]

OBSERVATIONS AND LESSONS LEARNED

Performance Observations and Lessons Learned

- Thermal desorption using the ATP system was effective in treating contaminants in soil at the Pristine site to levels below the cleanup goals. In addition, levels of six of the 11 targeted constituents were reduced to concentrations at or below the reported detection limits.
- Thermal desorption using the ATP system was also effective in reducing levels of seven additional constituents to the reported detection limit of 400 µg/kg.
- All stack gas air emission performance standards were met in this application, including standards for particulates, opacity, dioxins and furans, hydrogen chloride, THC, and SO_2. Surrogate compounds were used to verify compliance for a 99.99% DRE

OBSERVATIONS AND LESSONS LEARNED (CONT.)

Performance Observations and Lessons Learned

for PAHs and pesticides (1,2,3-trichlorobenzene for PAHs and chloromethylbenzene for pesticides).

- Occasional THC spikes were measured at levels greater than the performance standard; the vendor attributed these spikes to burner malfunction.

Other Observations and Lessons Learned

- Because SO_2 control was a particular concern in this application, several methods were used to control SO_2 during this application, including chemical addition and wet scrubbing.

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21. Comments on Draft Report from SoilTech, Received February 16, 1995.

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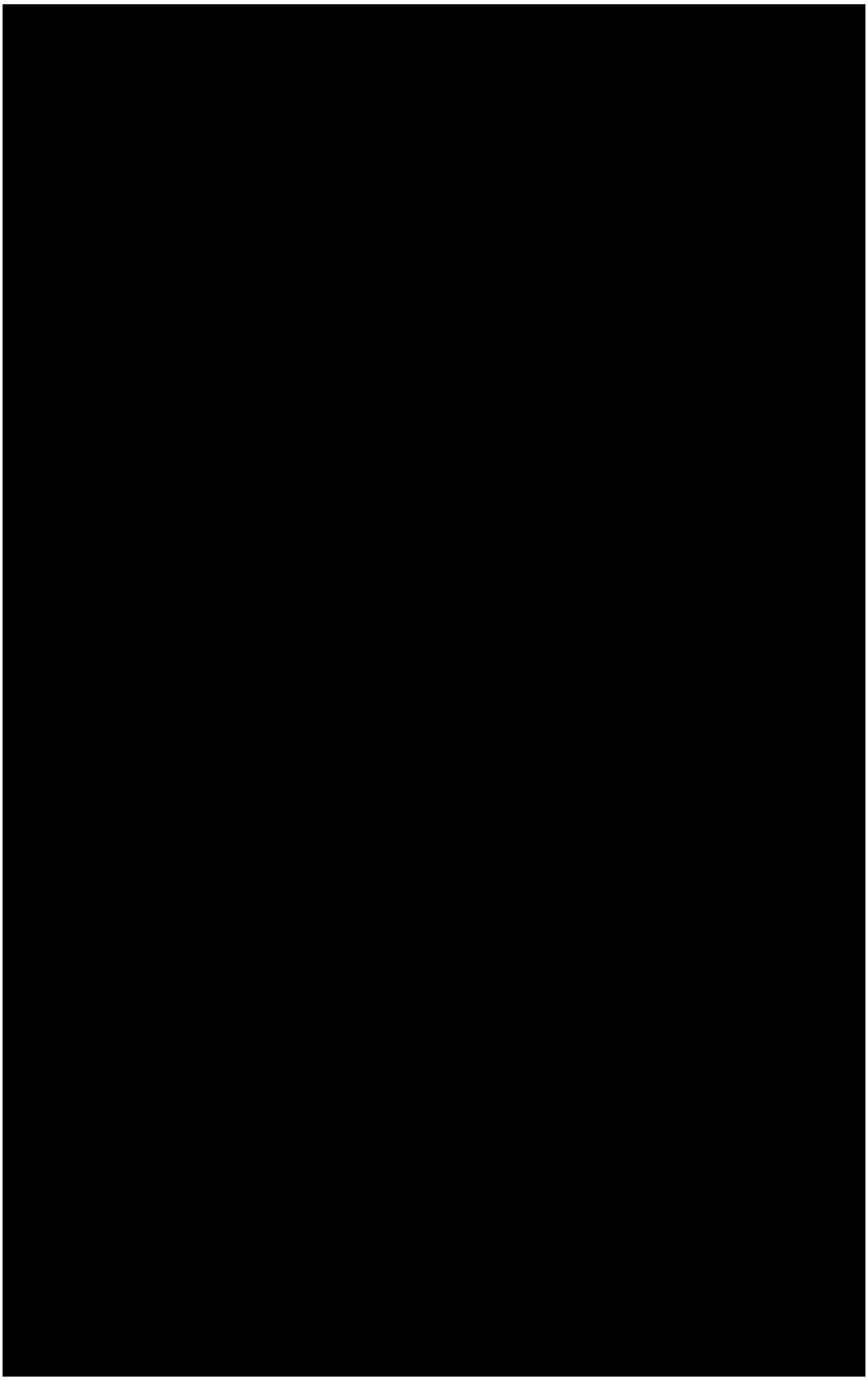
Analysis Preparation

This case study was prepared for the U.S. Environmental Protection Agency's Office of Solid Waste and Emergency Response, Technology Innovation Office. Assistance was provided by Radian Corporation under EPA Contract No. 68-W3-0001.

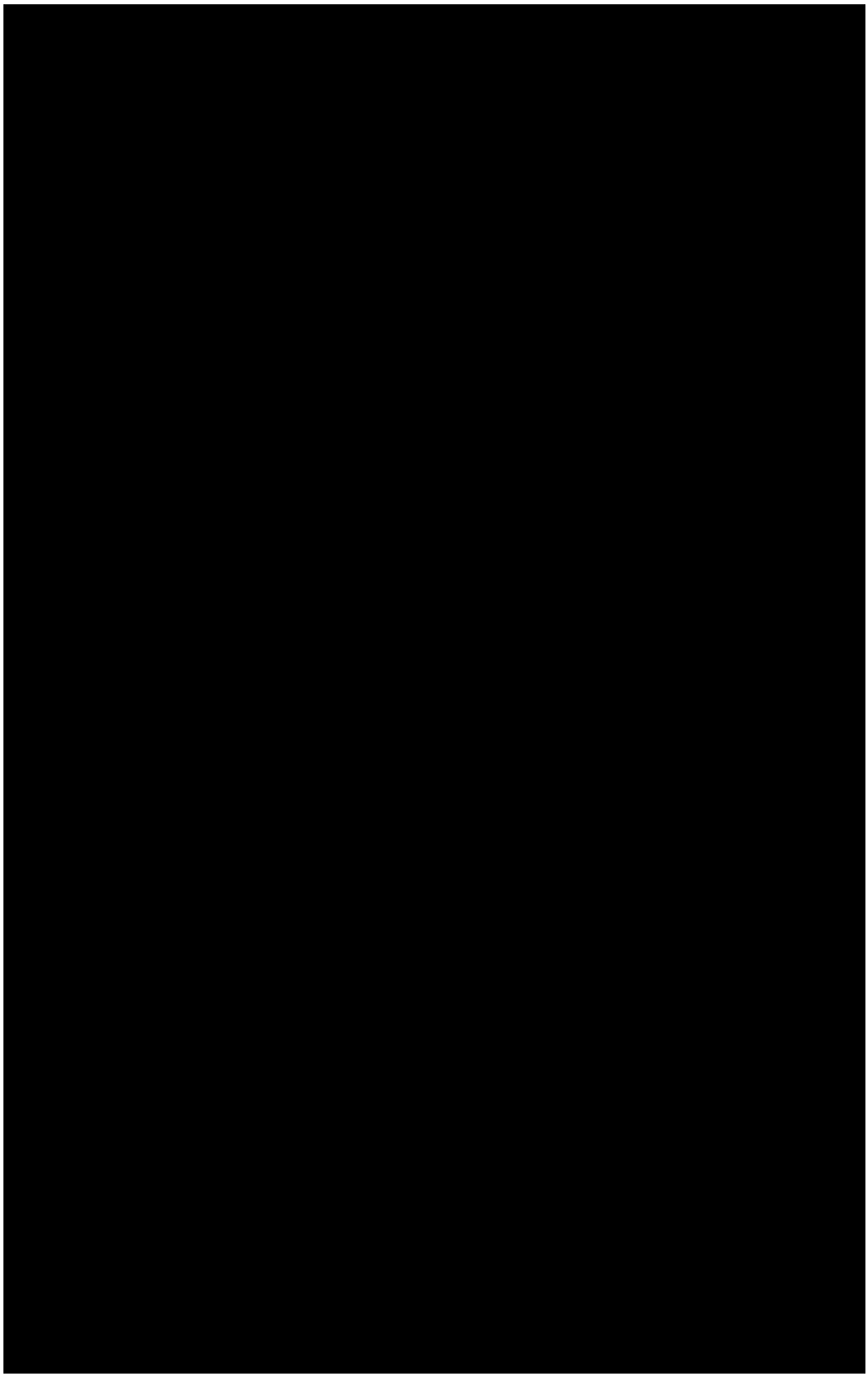
APPENDIX A

Summary of Analytical Results for the Treated Soil Piles at the Pristine Superfund Site



APPENDIX A (CONT.)

Summary of Analytical Results for the Treated Soil Piles at the Pristine Superfund Site



APPENDIX A (CONT.)

Summary of Analytical Results for the Treated Soil Piles at the Pristine Superfund Site

[redacted]

APPENDIX A (CONT.)

Summary of Analytical Results for the Treated Soil Piles at the Pristine Superfund Site

[redacted]

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Solid Waste and Emergency Response
Technology Innovation Office

COST AND PERFORMANCE REPORT

Thermal Desorption
at the
Pristine, Inc. Superfund Site
Reading, Ohio

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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