COST AND PERFORMANCE REPORT

EXECUTIVE SUMMARY

This report presents cost and performance data for a thermal desorption treatment application at the McKin Company Superfund site (McKin) located in Gray, Maine. McKin is a former waste collection, transfer, storage, and disposal facility. Soil at McKin was contaminated with halogenated volatile organic compounds (VOCs) and petroleum products, including polynuclear aromatic hydrocarbons (PAHs) and aromatic compounds. During the remedial investigation at McKin, soil contamination levels were measured as high as 1,500 mg/kg for trichloroethene (TCE), 49 mg/kg for methylene chloride, and 21 mg/kg for xylenes.

A Record of Decision (ROD) was signed in July 1995 and specified thermal desorption for treatment of contaminated soil at McKin. The ROD identified several areas at McKin that required treatment. These areas were grouped into a "VOC-contaminated area" and a "petroleum-contaminated area." The treatment performance standard stipulated in the ROD required treatment of TCE in the soil to a concentration of 0.1 mg/kg. In addition to the TCE requirement, treatment performance standards for PAHs and aromatic organics were specified for the petroleum-contaminated area. Ambient air monitoring was required during the application. Thermal desorption of approximately 11,000 cubic yards of soil was completed at McKin between July 1986 and April 1987.

Treatment performance and air monitoring data collected during this application indicated that all performance standards and monitoring requirements were achieved through use of the thermal desorption technology. This treatment application is notable for being one of the earliest full-scale applications of thermal desorption to remediate halogenated VOCs at a Superfund site.

Prior to completing the full-scale treatment application of thermal desorption at McKin, a pilot-scale treatability study was conducted from February to May 1986. The results of this treatability study indicated that thermal desorption achieved the TCE performance standard of 0.1 mg/kg. As a result of this treatability study, specific changes were incorporated into the design and operation of the full-scale remediation system.

The vendor stated that $2,900,000 were expended for the remediation of soils at McKin, including costs for salaries and wages, rental, supplies, subcontracts, fuel, and other professional services.

SITE INFORMATION

Identifying Information

McKin Company Superfund Site
Gray, Maine
CERCLIS # MED980524078
ROD Date: 07/22/85

Treatment Application

Type of Action: Remedial
Treatability Study Associated with Application? Yes (see Appendix A)
EPA SITE Program Test Associated with Application? No
Operating Period: July 1986 to April 1987
Quantity of Soil Treated During Application: 11,500 cubic yards

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SITE INFORMATION (CONT.)

Background

Historical Activity that Generated Contamination at the Site: Waste Collection, Transfer, Storage, and Disposal Facility

Corresponding SIC Code: 4953E (Refuse Systems-Sand and Gravel Pit Disposal)

Waste Management Practice that Contributed to Contamination: Disposal Pit

Site History: The McKin Company Superfund site (McKin) is located on the west side of Mayhall Road between Route 115 and Pownall Road in Gray, Maine, 15 miles north of Portland, Maine, as shown on Figure 1. This site was reportedly used as a sand and gravel pit prior to its purchase in 1963 by the McKin Company. From 1964 to 1978, the McKin Company operated a tank cleaning and waste removal business. The McKin site was used to collect, store, dispose, and transfer petroleum and industrial chemical waste until operations ceased in the late seventies. The site included 22 above-ground storage tanks, an asphalt-lined lagoon used for storage of wastes, and an incinerator. The incinerator was used to treat wastes from an oil tanker and was operated from about 1970 until 1973. [2]

In addition, wastes were discharged to the ground and buried on site. Between 1972 and 1977, 100,000 to 200,000 gallons of liquid waste were processed on site each year. A site plan for McKin is shown in Figure 2. [2]

Reports of groundwater and soil contamination began in 1973, when residents in East Gray reported odors in well waters and discoloration of laundry. Based on these reports, numerous investigations and activities were completed by the Maine Department of Environmental Protection (MDEP), the Town of Gray, and EPA. A Remedial Action Master Plan (RAMP) was prepared by EPA in April 1983. The RAMP recommended collecting appropriate data, developing a Remedial Investigation/Feasibility Study (RI/FS), and implementing some Initial Remedial Measures (IRMs). [2]

In June 1983, the MDEP entered into a Cooperative Agreement with EPA to implement the IRMs and develop the RI/FS. A ROD, signed in July 1983, required removal of the liquid wastes from the storage tanks. [2]

As a result of the remedial investigation, completed in February 1985, several areas of soil contaminated were identified. These areas were grouped into a "VOC-contaminated area" and a "petroleum-contaminated area." [2]

Regulatory Context: A ROD signed on July 22, 1985, required on-site thermal desorption treatment for soils in the VOC-contaminated area and the petroleum-contaminated area. The treatment performance standard stipulated in the ROD required treatment of TCE in the soil to a concentration of 0.1 mg/kg. In addition to the TCE requirement, treatment performance standards for PAHs and aromatic organics were specified for the petroleum-contaminated area.

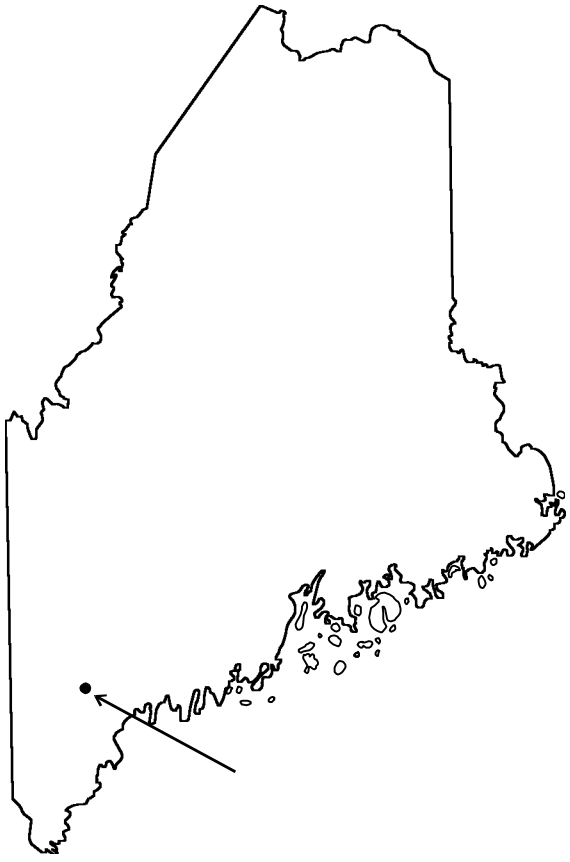

Figure 1. McKin Site, Gray, Maine [2]

SITE INFORMATION (CONT.)

Background (cont.)

EPA stipulated that prior to its use as a full-scale remedy for soil contamination at McKin, a pilot-scale study using thermal desorption was required to determine the effectiveness of treatment for soils at McKin and the impact on ambient air quality. [2]

Remedy Selection: Several alternative technologies were considered for the treatment of contaminated soils at the McKin site, including capping, landfilling, thermal desorption, and incineration. Thermal desorption was selected as a cost-effective alternative technology for remediation of soil from both contaminated areas at McKin.

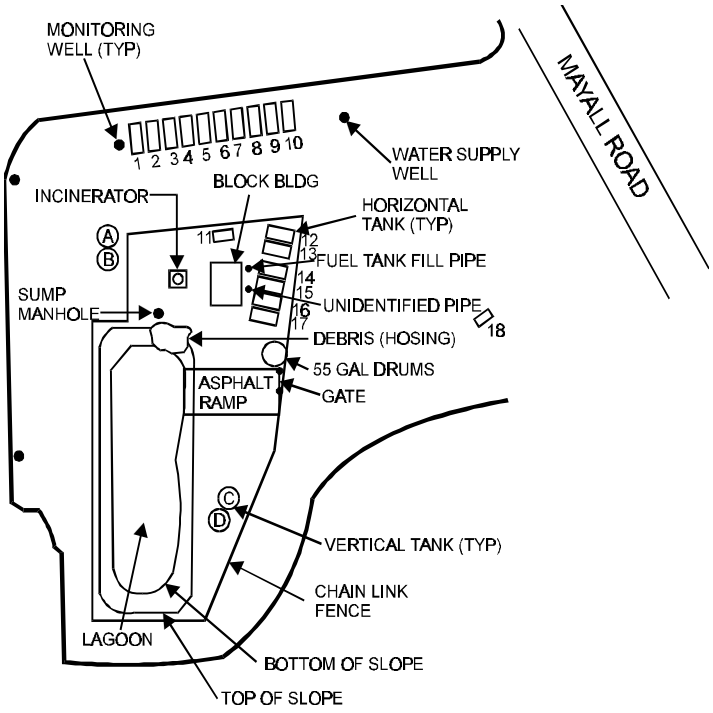

Figure 2. McKin Site Plan, Gray, Maine [2]

Site Logistics/Contacts

Site Management: PRP Lead

Oversight: EPA

Remedial Project Manager:
Sheila Eckman
U.S. EPA, Region 1
John F. Kennedy Federal Building, Room 2203
Boston, Massachusetts 02203
(617) 573-5784

Treatment Vendor:
Canonie Environmental
800 Canonie Drive
Porter, Indiana 46304
(219) 926-8651
(contact not available)

MATRIX DESCRIPTION

Matrix Identification

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

Contaminant Characterization

Primary Contaminant Groups: Halogenated volatile organic compounds; and Polynuclear Aromatic Hydrocarbons

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MATRIX DESCRIPTION (CONT.)

Contaminant Characterization (cont.)

Excavated soil treated in this application contained up to 3,310 mg/kg of TCE. [4] RI results indicated concentrations as high as 1,500 mg/kg for TCE, 49 mg/kg for methylene chloride, and 21 mg/kg for xylenes. [2]

Matrix Characteristics Affecting Treatment Cost or Performance

The major matrix characteristics affecting cost or performance for this technology are listed below; the values for these parameters are not provided in the available references:

- Soil classification
- Clay content and/or particle size distribution
- Moisture content
- Oil and Grease or Total Petroleum Hydrocarbons
- Bulk density
- Lower explosive limit

TREATMENT SYSTEM DESCRIPTION

Primary Treatment Technology Type:

Thermal Desorption

Supplemental Treatment Technology Types:

Pretreatment (Solids): Screening,; Mixing;
Post-treatment (Air): Baghouse, Scrubber;
Post-treatment (Water): Carbon Adsorption

Thermal Desorption Treatment System Description and Operation

The thermal desorption treatment system used at McKin, shown in Figure 3, consisted of pretreatment processes for screening and mixing, a cylindrical desorber, and an air treatment system.

Excavation and Pretreatment
Contaminated soil at McKin was excavated using buckets and augered steel cylinder caissons. The caissons were used to prevent collapse of excavation holes and reduce vaporization of organic contaminants from the soil. Excavated soil and debris were separated by screening the soil with a coarse grate. Petroleum-contaminated soils, which had a tendency to agglomerate or "ball up" in the desorber, were mixed with clean makeup soil prior to treatment to minimize this agglomeration. [4]

Thermal Desorber
The thermal desorber used at McKin was a rotating cylindrical drum 7 feet in diameter and 28 feet in length. Mixing and aeration were accomplished through use of longitudinal flights within the cylinder and rotation of the cylinder, at speeds of approximately 6 revolutions per minute. Forced hot air, generated by an oil burner, was used to heat the soil in the cylinder. To increase the residence time of soil in the cylinder, soil was treated with several passes through the cylinder. Soil was heated to an exit temperature of 250 to 400°F with a residence time of 6 minutes (2 minutes per pass and three passes through unit). [5]

A bucket elevator and chute system were used to transport treated soil to the head of the desorber or to a cement mixer. Treatment residuals (fines) were transported, using a series of augers, from a baghouse to a slurry box, and from the slurry box to a cement mixer. The cement mixer was used to increase the stability of the material prior to redisposition into excavation holes on site. [4]

TREATMENT SYSTEM DESCRIPTION (CONT.)

Thermal Desorption Treatment System Description and Operation (cont.)

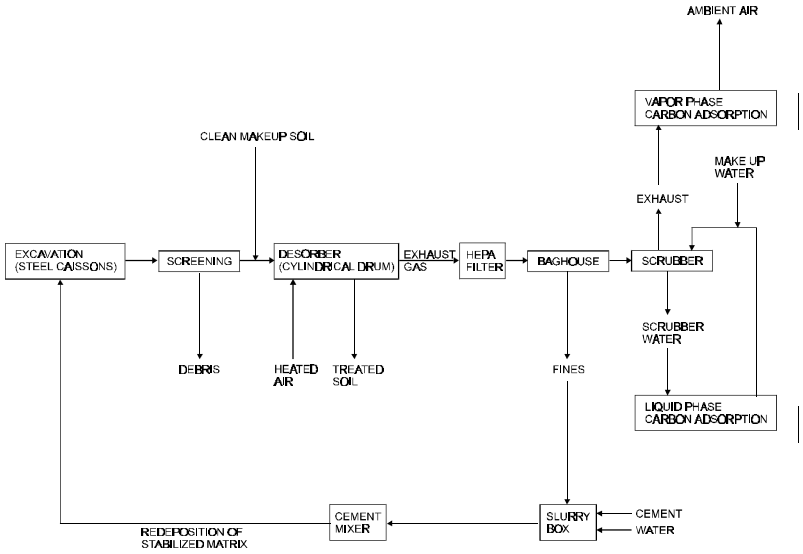

Figure 3. Thermal Desorption Treatment System Used at McKin [4]

Air Treatment System

The air treatment system used at McKin consisted of a HEPA filter, a baghouse, a scrubber, and a vapor-phase carbon adsorption system, in series. The system was designed to remove particulates and organic vapors from the desorber exhaust gases. The HEPA filter was used to remove smoky particulates (smokey particulates were identified during the pilot-scale study). The baghouse, which consisted of an enclosed series of six banks of fine-mesh synthetic fabric filters, was used to remove particulates. Baghouse fines were transported via augers to the slurry box. The countercurrent flow scrubber, a 10-foot tall cylindrical tower with a 6-foot diameter, filled with plastic packing media, was used to condition the air, remove water soluble chemicals, and remove most remaining particulates. Scrubber water was regenerated in a liquid phase carbon adsorption unit and recycled to the scrubber. Scrubber exhaust was treated using a vapor phase carbon adsorption unit, consisting of 15 tons of activated carbon. Scrubber exhaust entered through the bottom of the bed and then was exhausted to ambient air. [4]

Residuals

Residual solids (fines and treated soil) were mixed with cement and water and redeposited into the excavated caisson holes from the original on-site excavation. Additional residuals generated during this treatment application included 38 drums of spent HEPA filters, 29 drums of spent baghouse bags, and 42 drums of used Personal Protection Equipment (PPE) which were incinerated at Trade Waste Incineration of Sauget, IL. Spent vapor-phase carbon was regenerated by Calgon Carbon in Neville Island, PA and Columbus, OH. Between 1986 and 1987, 45,000 pounds of carbon were regenerated. An analysis of the spent carbon for total chlorinated compounds indicated concentrations of less than 1%. One thousand pounds of spent liquid-phase carbon were regenerated in 1987 by Adsorption Systems in Millburn, NJ. [4]

TREATMENT SYSTEM DESCRIPTION (CONT.)

Operating Parameters Affecting Treatment Cost or Performance

Table 1 presents the major operating parameters affecting cost or performance for this technology and the values measured for each during this treatment application.

Table 1. Operating Parameters [3, 4]

Parameter	Value	Measurement Method
Air Flow Rate	15,000 acfm	—
Residence Time per Pass	2 minutes	—
Number of Passes	3	—
Total Residence Time	6 minutes	—
System Throughput	8 to 9 cubic yards/batch	—
Temperature of Soil Exiting Heating Chamber	250 to 400ºF	Sensor at soil discharge chute

Timeline

A timeline for this application is shown in Table 2.

Table 2 . Timeline [1, 3]

Start Date	End Date	Activity
1964	1978	Tank cleaning and waste collection, transfer, storage, and disposal operations conducted at McKin
1979	1987	Interim remedial measures implemented
July 1983	—	First ROD signed
September 1983	—	McKin added to National Priorities List
July 1985	—	Second ROD signed
23 August 1985	—	Administrative order signed for conducting pilot-scale test
February 1986	April 1986	Pilot-scale study of thermal desorption conducted
7 July 1986	—	Administrative order signed for conducting full-scale treatment
July 1986	February 1987	Full-scale treatment of VOC-contaminated area soils using thermal desorption
March 1987	April 1987	Full-scale treatment of petroleum-contaminated area soils using thermal desorption
June 1987	—	Site demobilization

TREATMENT SYSTEM PERFORMANCE

Cleanup Goals/Standards

The 1985 ROD identified a performance standard for TCE in soil of 0.1 mg/kg averaged over a treatment volume. Samples of treated soil were required to be collected at the midpoint of each batch and analyzed for TCE. If the average concentration of TCE contained in these samples exceeded the performance standard, the soil treated that day was required to be retreated until the daily average concentration of TCE met the performance standard. [3]

For metal contaminants detected in soils at the McKin site, the ROD indicated that extraction procedure (EP) toxicity standards or results from solute fate and transport modeling would be protective of public health via groundwater contamination exposures. [2]

TREATMENT SYSTEM PERFORMANCE (CONT.)

Cleanup Goals/Standards (cont.)

Additional treatment performance standards for aromatic organic compounds and polynuclear aromatic hydrocarbons were specified in a contractor's report for the petroleum-area soils. [3] Performance standards for treatment of soil from the petroleum-contaminated areas at McKin were specified as 1 mg/kg for individual aromatic organic compounds, 1 mg/kg for individual PAHs, and 10 mg/kg for total PAH constituents. Samples were collected and analyzed for these additional parameters in a manner similar to that described above for TCE. The cleanup goals set for this application were technology-based. The vendor was given six weeks to demonstrate the technology's performance in treating site soils to the specified levels.

Volatile organic compounds, including TCE, were required to be analyzed on site using EPA Method 8010/8020. Semivolatile organic compounds were required to be analyzed using EPA Method 8270. Ten percent of the samples were required to be analyzed off site for confirmatory analyses. [3]

Continuous air monitoring was required for organic vapors near site activities and public notification was required if downwind organic vapors at the site perimeter were greater than 2 ppm above background. [5]

Treatment Performance Data [3]

Analytical data for VOCs and PAHs in soil measured during this application are shown in Tables 3 and 4, respectively. Ambient air monitoring at the site perimeter indicated that TCE was present at levels ranging from less than 0.002 up to 0.01 ppm, less than the 2 ppm above background action level. Air samples were collected using carbon and Tenax tube (charcoal tube) sampling, and desorbed using a NIOSH carbon disulfide procedure. [3]

Table 3. VOC Data [3]

Constituent	Maximum Untreated Soil Concentration (mg/kg)	Range of Treated Soil Concentrations (mg/kg)
Chloroform	30	Not analyzed
1,2-Dichlorobenzene	320	ND (0.02)
trans-1,1-Dichloroethene	6.1	ND (0.02)
Tetrachloroethane	120	ND (0.02)
1,1,1-Trichloroethane	19	ND (0.02)
Trichloroethene	3,310	ND (0.02) to 0.04

N/A = Not applicable
ND = Not detected. Number in parenthesis is the detection limit.

Table 4. PAH Data [3]

Constituent	Range of Treated Soil Concentrations (mg/kg)*
Acenaphthene	ND (0.66)
Anthracene	ND (0.17) to 0.975
Benzo(a)anthracene	ND (0.17) to 0.42
Chrysene	ND (0.17) to 0.495
Fluoranthrene	ND (0.33) to 0.38
Fluorene	ND (0.66)
Naphthalene	ND (0.66)
Phenanthrene	ND (0.33) to 2.5
Pyrene	ND (0.33) to 0.76

ND = Not detected. Number in parenthesis is the detection limit.
**From Table 8 of Reference [3]; covers period from 3/16/87 - 4/17/87.*

Performance Data Assessment

Soil sampling results for both VOC- and petroleum-contaminated areas indicate that the TCE performance standard was achieved during this application. Retreatment of soil was required only once during the full-scale remediation, on January 9, 1987. It was determined that a portion of the baghouse dust transfer chute was plugged at that time, with roots and debris, and inhibited the treatment of dust at that location. The transfer chute was cleaned and no subsequent retreatment was required.

The results shown in Table 3 indicate treatment of soil to levels below the reported detection limit for six chlorinated aliphatics.

TREATMENT SYSTEM PERFORMANCE (CONT.)

Performance Data Assessment (cont.)

The results for PAHs shown in Table 4 indicate treatment to levels less than 1 mg/kg, with one exception. The one exception, phenanthrene, was detected at levels ranging from 0.8 to 2.5 mg/kg during the last two weeks of treatment for petroleum-contaminated area soils. The average concentration of phenanthrene measured during the application was 0.92 mg/kg, and this value was accepted by EPA and MDEP as indicative of a successful application.

Performance Data Quality

Soil samples were analyzed on site using SW-846 analytical methods, and 10% of the samples were analyzed off site for confirmatory purposes. No exceptions to established data quality objectives were identified by the vendor for this application.

Performance Data Completeness

Data from this application are available for characterizing treated soil concentrations and for comparing these performance results with operating conditions.

TREATMENT SYSTEM COST

Procurement Process

The Potentially Responsible Parties (PRPs) contracted with Canonie Environmental to complete this treatment application. [3] No information is available at this time on the competitive nature of the procurement process.

Treatment System Cost

The vendor stated that $2,900,000 were expended for the full-scale remediation of soils at McKin, including costs for salaries and wages, rental, supplies, subcontracts, fuel, and other professional services. This value does not include costs for mobilization, site characterization, pilot-scale treatability study, waste material disposal, site closure, and demobilization. Table 5 shows a cost breakdown for the treatment of VOC - and petroleum contaminated soils, as provided by the vendor. [3]

No additional information is presented in the references to fully describe the items included in each cost element shown Table 5. Therefore, a cost breakdown using the interagency Work Breakdown Structure (WBS) is not provided in this report.

Table 5. Cost Breakdown Provided By Vendor [3]

Cost Elements	Cost Breakdown for Treatment of VOC-Contaminated Area Soils	Cost Breakdown for Treatment of Petroleum-Contaminated Area Soils
Salaries and Wages	$405,450	$88,910
Rental	$596,250	$130,880
Supplies	$453,150	$93,370
Subcontracts	$620,100	$135,980
Fuel	$47,700	$10,460
Other Professional Services	$262,350	$57,530
TOTAL	$2,385,000	$517,130

TREATMENT SYSTEM COST (CONT.)

Cost Data Quality

The costs shown in Table 5 were provided by the vendor in a site closeout report prepared for the PRPs. Limited information is available on the specific elements included in the total cost value.

OBSERVATIONS AND LESSONS LEARNED

Cost Observations and Lessons Learned

- The vendor stated that $2,900,000 were expended for the full-scale remediation of soils at McKin. The total cost value includes costs for salaries and wages, rental, supplies, subcontracts, fuel, and other professional services. Over 80% of the costs were for treatment of VOC-contaminated soils

Performance Observations and Lessons Learned

- Thermal desorption reduced concentrations of TCE in soil from levels as high as 3,310 mg/kg to less than the 0.1 mg/kg treatment performance standard for this application.
- Thermal desorption reduced concentrations of other volatile and semi-volatile organic contaminants from levels as high as 320 mg/kg to levels less than 1 mg/kg in this application with one exception for phenanthrene.
- Full-scale thermal desorption treatment of 11,500 tons of soil from the VOC- and petroleum-contaminated areas at McKin was completed within a 10-month period.
- Ambient air concentrations for TCE, ranged from less than 0.002 to 0.01 ppm.

Other Observations and Lessons Learned

- The pilot-scale treatability study accurately predicted that thermal desorption would be effective in treating soils at the McKin site and achieving the performance standard for the application.
- The following improvements to the design and operation of the full-scale remediation system were made based on the results of the pilot-scale treatability study:
  - Fugitive dust emissions were controlled by enclosing materials handling processes;
  - Temperature, residence time, and air flow were optimized for TCE removal efficiency;
  - Wetting procedures were determined to be ineffective and difficult to utilize in the system;
  - Addition of a HEPA filter to the exhaust gas treatment system reduced smoke particulates; and
  - The mixing of clean soil and petroleum contaminated soil eliminated agglomeration of the petroleum contaminated soil in the thermal desorption unit.
- The treatability study indicated that at temperatures below 250°F, there was not a significant reduction of TCE in the soil, and at temperatures above 350°F, the soil behaved as a viscous fluid on the conveyor bed and reacted violently with water during wetting.

REFERENCES

1. U.S. EPA Office of Emergency and Remedial Response. *Superfund Record of Decision: McKin Site, ME.* EPA/ROD/R01-83/003, Washington, D.C., July 1983.
2. U.S. EPA Office of Emergency and Remedial Response. *Superfund Record of Decision: McKin Site, ME (Second Remedial Action, 07/22/85).* EPA/ROD/R01-85/009, Washington, D.C., July 1985.
3. Canonie Environmental. Report, Soil Remediation and Site Closure - McKin Superfund Site, Gray, Maine. Prepared for: Potentially Responsible Parties. Project 84-130. July, 1987.
4. Webster, David. "Hazardous Waste Management, Pilot Study of Enclosed Thermal Soil Aeration for Removal of Volatile Organic Contamination at the McKin Superfund Site". In: *Journal of the Air Pollution Control Association.* Volume 36, No. 10. U.S. EPA Waste Management Division, Boston, MA. October 1986.
5. Webster, David M., "Pilot Study of Enclosed Thermal Soil Aeration for Removal of Volatile Organic Contamination at the McKin Superfund Site", presented at Engineering Foundation Conference on Alternative Technologies for Hazardous Waste Management; Henniker, New Hampshire, June 16-20, 1986.
6. NPL Public Assistance Database (NPL PAD); McKin Company, Maine; EPA ID # MED980524078; March 1992.

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—TREATABILITY STUDY RESULTS

Treatability Study Objectives

A pilot-scale treatability study was conducted from February through May 1986 by Canonie Environmental to determine the effectiveness of soil treatment at McKin and to assess the impact of treatment on ambient air quality. Approximately 400 cubic yards of soil from the VOC and petroleum areas at McKin were used for the study.

Treatability Study Test Description

The pilot-scale study consisted of four phases of tests in which operating parameters were varied and the treatment apparatus modified to optimize the system. A 100-foot crane, equipped with a kelly bar caisson rig and a digging bucket, was used for soil excavation. A front end loader equipped with a removable plastic cover was used to transfer contaminated soil to the treatment apparatus.

The soil treatment apparatus consisted of a rotating materials dryer fed by a conveyor belt. The dryer rotated at approximately six revolutions per minute at drying temperatures ranging from 150°F to 380°F. To enhance volatilization of contaminants, an oil burner produced hot air which was blown into the drying drum at flow rates between 7,500 and 15,000 cubic feet per minute (cfm). Pre- and post-treatment soil samples were analyzed for VOCs to determine if sufficient contaminant reduction had been achieved from aeration. After aeration in the dryer, treated soils were stabilized with a lean mixture of cement and redeposited into the excavation cavity.

The system also treated the resulting air exhaust from the dryer. Exhaust air was first vented through a baghouse which removed particulates. The collected particulates were then treated in a heated screw conveyor, which returned the treated particulates to the treated soil. Next, the exhaust traveled through an air scrubber to remove water soluble contaminants and remaining particles. Lastly, the exhaust was vented to a vapor phase carbon adsorption bed which removed VOCs.

Operating conditions were varied during each of the four phases of the pilot study. The first phase varied soil volume, dryer temperature, dry flue gas temperature, dryer air flow, soil wetting procedures for dust control, and baghouse operation. Phase Two focused on dryer temperature and air flow. Drying temperature was varied between 150°F and 325°F, and dryer airflow was set at 15,000 cfm. Furthermore, during Phase Two, soils were recirculated through the dryer 4 or 5 times. The purpose of Phase Three was to determine if desired treatment levels could be achieved in repeated runs, under full-day operation. During the second half of this phase, dryer temperatures were kept roughly constant, between 290°F and 310°F, and dryer airflow was set at 15,000 cfm. Soil volume was set at 3 cubic yards per run and residence time in the dryer was set at approximately 6 minutes for the three passes through the dryer. For Phase Four, the dust control and soil handling systems were modified. The conveyor belt was replaced with a bucket conveyor recirculation system. Also, treated soils were placed directly into the cement mixer truck, skipping the stockpiling step.

Site air was monitored throughout the study for any possible decline in ambient air quality caused by thee excavation and aeration of contaminated soils. Organic vapors and particulates were measured at various locations around the site perimeter and within the site to detect any danger to public health resulting from the treatment.

APPENDIX A—TREATABILITY STUDY RESULTS (CONT.)

Treatability Study Performance Data

The treatability study results showed that the thermal desorption system was effective in reducing TCE concentrations in the treated soil to less than 0.1 mg/kg using the higher temperatures and the maximum airflow tested. Fugitive particulate emissions could be controlled by enclosing much of the system. TCE concentrations in ambient air measured during the pilot-scale treatment did not exceed background levels. The study also determined that additional volatile organic contaminants such as BTEX could be treated with the same operating parameters as those used to optimize TCE removal efficiency.

The treatability study established a correlation with increased dryer temperatures (from 150°F to 380°F) and increased airflow (up to 15,000 cfm) with higher removal efficiencies of TCE. Higher removal efficiencies of TCE were also achieved by treating soils with multiple passes through the unit, thus increasing residence time. An optimum temperature of 300°F was determined on the basis that below 250°F there was not a significant reduction of TCE concentrations, and above 350°F the soil behaved as a viscous fluid on the conveyor bed and reacted violently with water during wetting.

During the treatability study, fugitive particulate emissions from transporting soils on belt conveyors within the treatment system were found to impede cycle times. Prior to the full-scale remediation, the conveyors were replaced with enclosed transport systems, using a bucket and chute system and augers to reduce fugitive particulate emissions. Wetting procedures were initially used, but were discontinued during the pilot-scale treatability test due to a lack of effectiveness in reducing emissions, interference with GC analysis of treated soils, and added difficulty in materials handling. Bluish smoke was observed during the pilot-scale treatability study, and was subsequently controlled by installing a HEPA filter at the dryer exhaust.

Treatability Study Lessons Learned

- The pilot-scale treatability study indicated that thermal desorption would be effective in treating soils at the McKin site and achieving the performance standards for this application.
- The following improvements to the design and operation of the full-scale remediation system were made based on the results of the pilot-scale treatability study:
  - Fugitive dust emissions were controlled by enclosing materials handling processes;
  - Temperature, residence time, and air flow were optimized for TCE removal efficiency;
  - Wetting procedures were determined to be ineffective and difficult to utilize in the system;
  - Addition of a HEPA filter to the exhaust gas treatment system reduced smoke particulates; and
  - The mixing of clean soil and petroleum contaminated soil eliminated agglomeration of the petroleum contaminated soil in the thermal desorption unit.

COST AND PERFORMANCE REPORT

Thermal Desorption
at the
McKin Company Superfund Site,
Gray, Maine

Prepared By:

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

March 1995

Notice

Preparation of this report has been funded wholly or in part by the U.S. Environmental Protection Agency under Contract Number 68-W3-0001. It has been subject to administrative review by EPA headquarters and Regional staff. Mention of trade names for commercial products does not constitute endorsement or recommendation for use.

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Office of Solid Waste and Emergency Response
Technology Innovation Office