On-Site Incineration at the
Rose Disposal Pit Superfund Site
Lanesborough, Massachusetts

Incineration at the Rose Disposal Pit Superfund Site
Lanesborough, Massachusetts

<table>
<tr><td>Site Name:
Rose Disposal Pit Superfund Site</td><td rowspan="2">Contaminants:
Primary Contaminant Groups:
PCBs, volatile organic compounds (VOCs) including TCE, benzene, and vinyl chloride
• PCBs at were detected at concentrations up to 440,000 mg/kg. The average PCB concentration was 500 mg/kg</td><td>Period of Operation:
February 1994 - July 1994</td></tr>
<tr><td>Location:
Lanesborough, Massachusetts</td><td>Cleanup Type:
Remedial action</td></tr>
<tr><td>Vendor:
Mark Phillips
Maximillian Technology
Pittsfield, MA
(413) 494-3027</td><td rowspan="2">Technology:
On-site incineration
• Soil was pretreated with crushing and shredding to achieve a homogenized incinerator feed
• Incineration system consisting of rotary kiln and secondary combustion chamber (SCC)
• SCC temperatures averaged 2000 ^{o}F
• Ash was discharged, and returned to the excavated areas on site</td><td>Cleanup Authority:
CERCLA
• ROD Date: 9/30/96, 11/21/89
• EPA-lead</td></tr>
<tr><td>SIC Code:
NA</td><td>Point of Contact:
Pam Shields
U.S. EPA Region 1</td></tr>
<tr><td>Waste Source:
Disposal of manufacturing wastes in an open trench</td><td colspan="2" rowspan="2">Type/Quantity of Media Treated:
Soil (51,000 tons)</td></tr>
<tr><td>Purpose/Significance of Application:
Incineration of PCB-contaminated soil</td></tr>
<tr><td colspan="3">Regulatory Requirements/Cleanup Goals:
Destruction and Removal Efficiency (DRE) of 99.9999% for PCBs as required by Toxic Substances Control Act regulations in 40 CFR part 761 subpart D</td></tr>
<tr><td colspan="3">Results:
Treatment performance and air monitoring data collected during this application indicated that all required performance and standards emissions were achieved.</td></tr>
</table>

Incineration at the Rose Disposal Pit Superfund Site
Lanesborough, Massachusetts

(Continued)

Description:
Between 1951 and 1959, the 14-acre residential lot received wastes from a nearby manufacturer. Soil at the site was contaminated with PCBs as well as volatile organic compounds (VOCs). A Record of Decision signed September 23, 1988 and November 21, 1989 specified on-site incineration as the remedial technology for the soil and sediments. Site cleanup goals and DRE standards were specified for constituents of concern.

On-site incineration began in February 1994 and was completed in July 1994. The treatment system consisted of a rotary kiln and an SCC. Kiln ash was treated and stored and treated gas was exhausted to a stack. Incineration has achieved the soil cleanup goals specified in the ROD.

No information was available on costs for the remedial action.

EXECUTIVE SUMMARY

This report presents cost and performance data for the application of on-site incineration at the Rose Disposal Pit Superfund Site (Rose Site) in Lanesborough, Massachusetts. A rotary kiln incinerator was operated from February 1994 to July 1994 as part of a remedial action.

The Rose site is a 1.5-acre section of a 14-acre residential lot located in Lanesborough, Massachusetts. From 1951 through 1959 and possibly later, wastes from a nearby manufacturer were disposed of in an open trench at the site. Soil at the Rose Site is contaminated with PCBs, as well as volatile organic compounds (VOCs) including trichloroethylene, benzene, and vinyl chloride. Measured concentrations of PCBs at the site were as high as 440,000 mg/kg.

In 1988, EPA signed a Record of Decision (ROD) specifying on-site incineration as the selected remedy for the contaminated soil at the Rose Site. In 1989, EPA released an Explanation of Significant Differences (ESD) which outlined EPA's agreement with the responsible party to conduct complete source remediation. To achieve complete source remediation, the responsible party excavated and incinerated a greater volume of contaminated soil than that specified in the ROD. The ROD set a Destruction and Removal Efficiency (DRE) standard for PCBs of 99.9999%.

The remediation activities performed at the Rose Site also included the construction and operation of a groundwater treatment system, However, unless otherwise indicated, only issues relating to on-site incineration are discussed in this report.

The excavated soil at the Rose Site was crushed and blended before incineration. The blended soil entered the rotary kiln at the flame end via a screw auger and passed through the kiln co-current with the exhaust gas. Kiln ash was quenched in a water bath, while the exhaust gases were directed to a secondary combustion chamber (SCC) for further destruction of contaminants in the waste feed.

The air pollution control train consisted of a cyclone separator for removal of larger particulate matter, a quench tower, a baghouse for removal of finer particulate matter, a second quench tower, and a wet scrubbing system designed to remove residual contaminants. Dust removed by the cyclone separator and the baghouse was discharged to the ash quench bath. Wastewater from the quench towers and the scrubbing system was also discharged to the ash quench bath. All of the solid waste generated by the system was removed with the incinerator ash and landfilled on site.

During its five months of operation, the incinerator processed approximately 51,000 tons of contaminated soil. Treatment performance and air monitoring data collected during this application indicated that all required performance and standards emissions were achieved.

SITE INFORMATION

Identifying Information

Rose Disposal Pit Superfund Site
Lanesborough, Massachusetts

CERCLIS # MAD980524169

ROD Date: September 23, 1988 (ROD)
November 21, 1989 (ESD)

Treatment Application

Type of action: Remedial (on-site rotary kiln incineration)

Period of operation: February 1994 - July 1994

Quantity of material treated: 51,000 tons of contaminated soil

Background

Historical Activity that Generated Contamination at the Site: The site was used for disposal of waste generated from many different manufacturing processes.

Corresponding SIC Codes: NA

Waste Management Practice That Contributed to Contamination: Disposal of manufacturing waste in an open trench.

Site History:

- The Rose Site is located on Balance Rock Road in Lanesborough, Massachusetts approximately 4 miles north of Pittsfield. The site is bounded on the north and northeast by the deciduous forest of Balance Rock State Park, on the east and southeast by cropland and pasture, on the west by mixed forest, and on the southwest by a residential area.
- The Rose Site is the location of a trench used for disposal of manufacturing wastes generated by the responsible party between 1951 and 1959. The wastes contained PCBs and VOCs.
- Between 1980 and 1982, EPA conducted the preliminary assessment, site inspection, and field investigation. All subsequent activities at the site have been performed by the responsible party.
- A remedial investigation (RI) was conducted in 1983 and supplemented in 1986, and the feasibility study (FS) was conducted in 1988.
- Based on the results of the RI and the FS, a ROD was signed on September 23, 1986 specifying excavation and on-site incineration of contaminated soils. The ROD specified excavation of the contaminated soil to the top of the saturated zone.
- In 1989, EPA released an ESD which outlined EPA's agreement with the responsible party to conduct complete source removal. Under this agreement, the responsible party excavated additional soil below the saturated zone. Complete source removal allowed the responsible party to avoid installing a cover and establishing other long-term institutional controls.
- Approximately 51,000 tons of soil were processed between February 1994 - July 1994. By July 1994 all of the cleanup goals had been met for the contaminated soil, and incineration had ceased.

Regulatory Context:

- In 1984, the Rose Site was added to the National Priorities List (NPL).
- A ROD was signed in 1988 requiring the responsible party to conduct remedial activities at the Rose Site.

SITE INFORMATION (CONT.)

Background (Cont.)

- In 1989, EPA released an ESD which outlined EPA's agreement with the responsible party to conduct complete removal; this action was more aggressive then that associated with the goals set forth in the ROD.
- The DRE and ash residual standards were established the provisions of the Toxic Substance(s) Control Act (TSCA) and associated regulations in 40 CFR part 761 subpart D.
- The selected remedy is consistent with the Comprehensive Emergency Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Contingency Plan (NCP) in 40 CFR part 300.

Remedy Selection: EPA determined that on-site incineration was the only available alternative that satisfied all of the criteria established in the ROD, particularly permanence, and that on-site incineration was more cost effective than off-site incineration for the Rose Site [1]**.**

Timeline

Table 1. Timeline [1,2,3]

Date	Activity
1951-1959	Wastes are disposed of by the RP at the Rose Disposal Pit site.
1980-1982	Preliminary assessment, site inspection, and field investigation performed by EPA.
1983	A remedial investigation is conducted by responsible party.
1984	Site is listed on the NPL
May 1984	The responsible party secured the site and covered the disposal area in response to an Administrative Order from EPA.
1986	A supplemental remedial investigation is conducted by responsible party.
1988	Feasibility study conducted by responsible party
September 23, 1988	Record of Decision signed
November 21, 1989	Explanation of Significant Differences is issued
October 1993	Trial burn
February 1994	Interim operations of the incinerator began
April 1994 - July 1994	Rotary kiln incinerator operational for full-scale treatment

Site Logistics/Contacts

Site Management: RP-lead

Oversight: EPA

Remedial Project Manager:
Pam Shields
U.S. EPA Region 1

State Contact:
Jay Naparstek
Massachusetts Department of Environmental Protection
(617) 292-5697

Treatment System Vendor:
Mark Phillips
Maximillian Technology
Pittsfield, MA
(413) 494-3027

MATRIX DESCRIPTION

Matrix Identification

Type of Matrix Processed Through the Treatment System:
Contaminated soil excavated from the disposal pit both above and below the saturated zone.

Contaminant Characterization

Primary Contaminant Groups: PCBs, volatile organic compounds (VOCs) including TCE, benzene, and vinyl chloride.

- PCBs at were detected at concentrations up to 440,000 mg/kg. The average PCB concentration was 500 mg/kg.

Matrix Characteristics Affecting Treatment Costs or Performance

The matrix characteristics that most significantly affected cost or performance at this site and their measured values are presented in Table 2.

Table 2. Matrix Characteristics of Soil [1,3]

Parameter	Value
Soil Density	1.6 g/cc
Heat content	290 Btu/lb
Ash	86%
Chlorine Content by weight	0.38%

TREATMENT SYSTEM DESCRIPTION

Primary Treatment Technology

Rotary kiln incineration system, including:
- Waste feed handling system
- Rotary kiln incinerator
- Secondary combustion chamber

Supplemental Treatment Technology

Air Pollution Control System, including:
- Cyclone separator
- Baghouse
- Quench towers
- Wet scrubbing system

System Description and Operation

- The soil at the Rose Site was excavated and transported to the crusher/shredder. The crusher/shredder was used to reduce the particle size of the soil feed to less than 0.75 inches. The crushed soil was transported to the soil blending building where it was blended before incineration to achieve a homogenized incinerator feed. The soil blending building was equipped with a vapor-phase carbon filtration system designed to reduce possible PCB or VOC emissions.

- The soil feed entered the kiln at the flame end and traveled through the kiln co-current with the combustion gases. Ash and exhaust gases were discharged from the kiln.

- Kiln ash was quenched in a water bath and discharged to a storage area. The solids in the ash quench bath were allowed to settle and were continuously removed.

TREATMENT SYSTEM DESCRIPTION (CONT.)

System Description and Operation (Cont.)

- The co-current rotary kiln was 110 feet long with an internal diameter of approximately 8 feet. The kiln consisted of three refractory-lined cylindrical sections bolted together at flanged connections to function as one unit. The kiln was designed for an optimal throughput of approximately 50 tons of contaminated soil per hour.
- The kiln was fired with oxygen, fuel oil, and excess air. The kiln-drive system employed a 200-hp motor.
- The kiln exhaust gases were directed to a cyclone separator for removal of larger particulates. Exhaust gases entered the cyclone separator tangentially allowing larger particles to fall out. Particles separated from the exhaust gas fell to the bottom of the cyclone and were transported to the ash quench bath.
- The exhaust gas then entered the SCC which provided further destruction of remaining contaminants. The SCC was 52 feet long and had an internal diameter of 11 feet. It was lined with refractory brick and is fired with oxygen, fuel oil, and excess air.
- Exhaust gas from the SCC was cooled in a quench tower from approximately 2,000 °F to approximately 425 °F. Quench nozzles in the tower spray atomized recycled water into the gas stream.
- The quenched exhaust gas was then drawn into a baghouse. The baghouse consisted of 1,020 woven fiberglass bags. Each bag had a 6-inch diameter and length of 10 feet for a surface area of 16 square feet per bag. The total filter area of the baghouse was approximately 16,300 square feet. The dust removed in the baghouse was discharged to the ash quench bath.
- The exhaust gases from the baghouse were then quenched in a second quench tower similar to the one previously described.
- The filtered and quenched exhaust gases were drawn through a packed-tower-design wet scrubber. Scrubbing was achieved by spraying caustic solution over the packed bed as the exhaust gas flowed up through the bed. Scrubber wastewater was continuously recycled, with a bleed stream discharged to the ash quench bath.
- Gases were forced out of the scrubber and into the exhaust stack which was mounted on top of the scrubber. The stack released gas to the atmosphere at approximately 200 °F. The internal diameter of the stack was 4.5 feet and the height above the ground was 66 feet.
- The solids in the quench bath included all of the residuals from the air pollution control units as well as the ash from the incinerated soil. These solids were sampled and analyzed using the TCLP and eventually returned to the excavated areas on site.

TREATMENT SYSTEM PERFORMANCE

Cleanup Goals/Standards

- The cleanup goals and standards were specified in the ROD. The DRE was set based on TSCA regulations 40 CFR part 761 subpart D. [1]
- The soil cleanup level was 13 mg/kg for PCBs. This corresponds to a 1 x 10^{-5} excess lifetime cancer risk level for the average case.
- The required DRE was 99.9999% for PCBs.
- The maximum concentration of PCBs in the residual ash was set at 2 mg/kg.

Treatment Performance and Compliance

- A trial burn conducted at the Rose site was designed to operate the incineration system at conditions that would reflect worst-case destruction and removal of all constituents of concern.
- PCBs were determined to be present in the soil at sufficient concentrations such that spiking with PCBs or principle organic hazardous constituents (POHCs) was not necessary.
- The AWFCOs limits during the operation of the incinerator are shown in Table 4. Information about the frequency of AWFCOs was not available. The values of various operating parameters as measured during the trial burn are shown in Table 5; information on actual values of these parameters during operation was not available.
- The average concentration of PCBs in the residual ash was 0.0618 mg/kg.

Table 3. Average Destruction and Removal Efficiencies from Compliance Testing

Contaminant	Average Contaminant Feed Rate in Soil (lb/hr)	Average Contaminant Rate in Stack Gas Emissions (lb/hr)	Average Contaminant Rate in Residuals	DRE (%)
PCB	742.5	9.4×10^{-4}	NA	99.99987

Table 4. Automatic Waste Feed Cutoffs[a]

Parameter	Cutoff Limit
Maximum pressure kiln at entry	-0.05 w.c.
Minimum afterburner gas exit temperature, instantaneous	1,915°F
Minimum afterburner residence time, instantaneous	2 seconds
Minimum pH at scrubber sump	5
Minimum flow scrubber recirculation line	450 gpm
Maximum CO (7% O_2)	100 ppmv
Minimum O_2 (dry volume)	3%
Minimum combustion efficiency	99.9%
Maximum temperature quench #1 gas exit	500°F
Maximum temperature scrubber entry	300°F

[a]Recommended limits from Trial Burn Report.

TREATMENT SYSTEM PERFORMANCE (CONT.)

Table 5 Operating Parameters [3]

Parameter	Trial Burn Value
SCC Exit Gas Temperature	2,100 °F
Soil Feed Rate	51.8 tons/hour
PCB Feed Rate	740 lb/hr
Kiln Fuel Oil Feed Rate	1,734 lb/hr
Kiln Pressure	-0.6 inches w.c.
Quench #1 Exit Temperature	394 °F
SCC Residence Time	4.8 seconds
Scrubber Entry Temperature	208 °F
Scrubber Recirculation Flow	575.8 gpm
Scrubber pH	7.5 s.u.
Stack Gas Carbon Monoxide (60-Minute Rolling Average)	9.9 ppmv
Stack Gas Oxygen (Dry Basis)	9.0 vol %
Secondary Draft	-0.71 inches w.c.
Combustion Efficiency	99.991

w.c. = Water column
s.u. = Standard pH units

Table 6. TCLP Comparison for Residual

Constituent	Regulatory Threshold (mg/L)	Average TCLP Concentration (mg/L)
1,4-Dichlorobenzene	7.5	0.010
2-Methylphenol (o-cresol)	200.0	0.010
m-cresol/p-cresol	200.0	0.021
Hexachloroethane	3.0	0.010
Nitrobenzene	2.0	0.010
Hexachlorobutadiene	0.5	0.010
2,4,6-Trichlorophenol	2.0	0.010
2,4,5-Trichlorophenol	400.0	0.010
2,4-Dinitrotoluene	0.13	0.010
Hexachlorobenzene	0.13	0.010
Pentachlorophenol	100.0	0.021
Pyridine	5.0	0.010

TREATMENT SYSTEM PERFORMANCE (CONT.)

Table 6. TCLP Comparison for Residual

Constituent	Regulatory Threshold (mg/L)	Average TCLP Concentration (mg/L)
Arsenic	5.0	<0.138
Barium	100.0	0.846
Cadmium	1.0	<0.0066
Chromium	5.0	0.0137
Lead	5.0	0.124
Mercury	0.2	<0.0070
Selenium	1.0	<0.0219
Silver	5.0	<0.0133
Vinyl Chloride	0.2	<0.011
1,1-Dichloroethene	0.7	<0.011
Chloroform	6.0	<0.011
1,2-Dichloroethane	0.5	<0.011
2-Butanone (MEK)	200.0	<0.011
Carbon Tetrachloride	0.5	<0.011
Trichloroethene	0.5	<0.011
Benzene	0.5	<0.011
Tetrachloroethene	0.7	<0.011
Chlorobenzene	100.0	<0.011
gamma-BHC (Lindane)	0.4	<0.1
Endrin	0.02	<0.005
Methoxychlor	10.0	<1.0
Toxaphene	0.5	<0.1
Heptachlor	0.008	<0.003
Heptachlor Epoxide	0.008	<0.003
Chlordane	0.03	<0.01

OBSERVATIONS AND LESSONS LEARNED (CONT.)

Performance Data Quality

- According to site personnel the QA/QC program used throughout the remedial action met all EPA requirements. All monitoring was performed using EPA-approved methods, and the vendor did not note any exceptions to the QA/QC protocols. [3]

TREATMENT SYSTEM COST

Procurement Process

- According to site personnel the responsible party contracted with Clean Berkshires, Inc. (CBI) To provide design/remedial services at the site. CBI used several subcontractors to implement specific aspects of the operation. [3]

Cost Data

- Information on the costs of on-site incineration was not available.

OBSERVATIONS AND LESSONS LEARNED

Observations and Lessons Learned

- The incinerator was constructed during the winter of 1992. Heavy snowfalls and low temperatures hampered the progress of workers.
- Cold weather also affected incinerator startup, which occurred in January 1994. The extreme temperatures caused various problems with water used for cooling. In addition, valves cracked, solenoids remained closed or open, and air lines froze.

OBSERVATIONS AND LESSONS LEARNED (CONT.)

Public Involvement

- Citizens expressed concern that the incineration and excavation process would create excessive noise. EPA worked with local officials to minimize the adverse impacts of the site remediation activities. [1]
- Many public meetings were held, and EPA and state personnel met individually with local officials and residents to discuss specific concerns. Neighborhood residents formed a group that worked with EPA to address public concerns.
- The RP setup a neighborhood network that used volunteer neighbors to periodically distribute fact sheets regarding the site incineration project.

REFERENCES

1. Superfund Record of Decision, Rose Disposal Pit Site, Lanesborough, Massachusetts, September 23, 1988.
2. Memorandum - Explanation of Significant Differences, Rose Disposal Pit Site, Lanesborough, Massachusetts, November 21, 1989.
3. Trial Burn Report for the Clean Berkshires, Inc. High Temperature Incinerator (HTI) System, Rose Disposal Pit Superfund Site, Lanesborough, Massachusetts, December, 1993.
4. Remedial Action Completion Report. F.T. Rose Superfund Site, September 1994.