On-Site Incineration at the
Rose Township Dump Superfund Site
Holly, Michigan

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<table>
<tr><td>Site Name:
Rose Township Dump Superfund Site</td><td rowspan="2">Contaminants:
PCBs, metals, and volatile and semivolatile organic compounds

• Most common contaminants (and maximum concentrations) were toluene (4,700 mg/kg), ethylbenzene (430 mg/kg), chlorobenzene (570 mg/kg), xylene (1,400 mg/kg), naphthalene (31 mg/kg), pentachlorophenol (32 mg/kg), acetone (76 mg/kg), and total phthalates (91 mg/kg)</td><td>Period of Operation:
September 1992 - October 1993</td></tr>
<tr><td>Location:
Holly, Michigan</td><td>Cleanup Type:
Remedial Action</td></tr>
<tr><td>Vendor:
OHM Remediation Services Corp.
16406 U.S. Route 224 East
Findlay, OH 45840</td><td rowspan="2">Technology:
On-Site Infrared Incineration
• Excavated material screened and blended with fuel oil prior to incineration
• PCBs and VOCs volatilized and partially destroyed in primary combustion chamber
• Kiln ash quenched by water-cooled screw
• Exhaust gas from kiln directed to air pollution control system, consisting of secondary combustion chamber (SCC)
• Wastewater treated on-site and discharged under NPDES permit</td><td>Cleanup Authority:
CERCLA and State: Michigan
• ROD signed 9/30/87
• EPA-lead</td></tr>
<tr><td>SIC Code:
N/A</td><td>Point of Contact:
Kevin Adler
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Phone: 312-886-7078

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Michigan Department of Environmental Quality
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Phone: 517-373-4824</td></tr>
</table>

Incineration at the Rose Township Dump Superfund Site
Holly, Michigan

(Continued)

Waste Source:
Waste disposal areas in landfills and surface impoundments — wastes included spent solvents, paint sludges, lead battery sludges, waste oils

Type/Quantity of Media Treated:
Soil
- 34,000 tons of surface and subsurface soil

Purpose/Significance of Application:
Operating in winter led to weather-related difficulties resulting in suspension of the operation until spring.

Regulatory Requirements/Cleanup Goals:
- Destruction and Removal Efficiency (DRE) of 99.9999% for principal organic hazardous materials as required by Resource Conservation and Recovery Act (RCRA) regulations in 40 CFR part 264, subpart O; DRE of 99.9999% for PCBs as required by Toxic Substances Control Act (TSCA) regulations in 40 CFR part 761

Results:
- EPA determined that demonstration of a 99.9999% DRE for PCBs was not necessary during the trial burn because (1) substantial hazards were associated with transporting and storing concentrated PCB oils, and (2) the unit had demonstrated the ability to adequately destroy PCBs in order to obtain its TSCA permit

Description:
From 1966 to 1968 approximately 5,000 drums containing spent solvents, paint sludges, lead battery sludges, and waste oils were buried in a 12-acre area at the Rose Township Dump site. Bulk wastes were also discharged to the surface or into shallow lagoons or pits in the area. On September 30, 1987, EPA signed a Record of Decision (ROD) specifying on-site incineration as the selected remedy for contaminated soil at the site. A consent decree was signed by 12 potentially responsible parties (PRPs) and EPA in 1988 to remediate the site.

The incinerator used to process soils at the site was the OHM Mobile Infrared Thermal Destruction Unit (TDU). The PCBs and VOCs were volatilized and partially destroyed in the primary combustion chamber. Off-gases from the preliminary combustion chamber were routed to a secondary combustion chamber (SCC) for further destruction of any remaining VOCs and PCBs. Kiln ash was quenched by a water-cooled screw. During the on-site incineration remedial action, 34,000 tons of contaminated soil were incinerated. Treatment performance and emissions data collected during this application indicated that all performance standards and emissions requirements were achieved.

The total cost for remediation using the incineration system was approximately $12 million.

EXECUTIVE SUMMARY

This report presents cost and performance data for the application of on-site incineration at the Rose Township Dump Superfund Site (Rose Township Site) in Holly, Michigan. An infrared incinerator was operated from September 1992 through October 1993 as part of a remedial action. The contaminants of concern at the Rose Township site were PCBs, metals, and volatile and semivolatile organic compounds.

From 1966 to 1968 approximately 5,000 drums containing spent solvents, paint sludges, lead battery sludges, and waste oils were buried in a 12-acre area at the Rose Township Dump site. Bulk wastes were also discharged to the surface or into shallow lagoons or pits in the area.

During the Remedial Investigation (RI), PCBs were detected in the soil at concentrations up to 980 mg/kg. The majority of PCB contamination was contained in an area approximately 200 feet by 750 feet. Excavation of material to depths of 22 feet was required to meet the cleanup goals. Lead was detected at concentrations up to 3,200 mg/kg. A variety of volatile and semivolatile organic compounds also were detected in soils during the RI. The most common contaminants (and maximum concentrations) were toluene (4,700 mg/kg), ethylbenzene (430 mg/kg), chlorobenzene (570 mg/kg), xylene (1,400 mg/kg), naphthalene (31 mg/kg), pentachlorophenol (32 mg/kg), acetone (76 mg/kg), and total phthalates (91 mg/kg).

On September 30, 1987, EPA signed a Record of Decision (ROD) specifying on-site incineration as the selected remedy for contaminated soil at the Rose Township Site. Performance standards for the incineration process included a destruction and removal efficiency (DRE) of 99.9999% for PCBs. A consent decree was signed by 12 potentially responsible parties (PRPs) and EPA in 1988 to remediate the site.

Remedial actions were managed by Perini Environmental, a remedial contractor hired by the PRPs, and were performed under the oversight of EPA Region 5.

Contaminated soil was excavated using backhoes and longarms. Prior to incineration, excavated material was screened to less than one inch in diameter, and blended with fuel oil to achieve the desired BTU value. Wet soil was dried in a drying building by heaters and blowers prior to screening. Oversize rocks, tree stumps, and personal protective equipment were shredded and incinerated. Intact drums unearthed during the excavation of soil were disposed of off the site.

The incinerator used to process soils at the Rose Township site was the OHM Mobile Infrared Thermal Destruction Unit (TDU). Off-gases from the preliminary combustion chamber were routed to a secondary combustion chamber (SCC) for further destruction of any remaining VOCs and PCBs. Kiln ash was quenched by a water-cooled screw.

Exhaust gas from the kiln was directed to an air pollution control system (APCS). The APCS consisted of a water spray to reduce the temperature of the SCC exit gas, a low-energy venturi scrubber and a packed bed adsorber to control particulates and acid gas, and a high-energy venturi scrubber and mist eliminator to control metals emissions and remove additional particulates. All of the wastewater generated by the system was treated on site and discharged under a NPDES permit.

During the on-site incineration remedial action, 34,000 tons of contaminated soil were incinerated. Treatment performance and emissions data collected during this application indicated that all performance standards and emissions requirements were achieved.

The total cost for remediation using the incineration system was approximately $12 million.

SITE INFORMATION

Identifying Information

Rose Township Dump Superfund Site
Holly, Michigan

CERCLIS #: MID980499842

ROD Date: September 30, 1987

Treatment Application

Type of action: Remedial (on-site infrared incineration)

Period of operation: September 1992 - October 1993

Quantity of material treated during application: 34,000 tons of contaminated soil

Background

Historical Activity that Generated Contamination at the Site: Dumping of spent solvents, paint sludges, lead battery sludges, and waste oils. No manufacturing or other industrial activity was conducted at this site.

Corresponding SIC Code: Not applicable

Waste Management Practice That Contributed to Contamination: Waste disposal in landfills and surface impoundments

Site History:

- The Rose Township site occupies a 110-acre parcel of land. A portion of the site was used for farming from the 1950s to the 1960s. From 1966 to 1968 approximately 5,000 drums containing spent solvents, paint sludges, lead battery sludges, and waste oils were buried in a 12-acre portion of the site. An undetermined amount of bulk wastes were also discharged to the surface or into shallow lagoons or pits in the area.
- The results of investigations at the site indicate that surface and subsurface soils and groundwater at the site were contaminated with PCBs, metals, and volatile and semivolatile organic compounds.
- In April 1979, the Michigan Department of Natural Resources (MDNR) surveyed the site and identified approximately 1,500 drums of unknown contaminants.
- A search warrant obtained in June of 1979 allowed the drums to be sampled by the MDNR to identify their contents.
- Based on the results of 1979 drum sampling, a toxic substances emergency was declared by the Michigan Toxic Substances Control Commission. A removal action, completed in July 1980 resulted in the removal of over 5,000 drums from the site for off-site disposal.
- A Remedial Investigation [RI] and a Feasibility Study [FS] were initiated at the Rose Township Site in February of 1984 and were completed in June of 1987.
- On September 30, 1987, EPA signed a Record of Decision (ROD) specifying on-site incineration as the selected remedy for the contaminated soil at the Rose Township Site. An amendment to the ROD was issued in 1989.
- From September 1992 until October 1993, an infrared incinerator operated at the Rose Township Site as part of a remedial action. During the remedial action, 34,000 tons of contaminated soil were incinerated.

SITE INFORMATION (CONT.)

Regulatory Context:

- The Rose Township Site was placed on the National Priorities List (NPL) in 1982.
- On September 30, 1987, EPA signed a Record of Decision (ROD) specifying the site cleanup requirements.
- A consent decree was signed by 12 Potentially responsible parties (PRPs) and EPA in 1988 to remediate the site.
- The DREs were set in accordance with Resource Conservation and Recovery Act (RCRA) incinerator regulations in 40 CFR part 264, subpart O and Toxic Substances Control Act (TSCA) regulations in 40 CFR part 761.
- The selected remedy was conducted under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), the Superfund Amendments and Reauthorization Act of 1986 (SARA) and the National Contingency Plan (NCP) in 40 CFR part 300.

Remedy Selection: EPA determined that on-site incineration would be protective of human health and the environment, and cost effective. EPA further determined that on-site incineration satisfied the CERCLA requirement that the remedy reduce toxicity, mobility, or volume of the waste.

Timeline

Table 1. Timeline

Date	Activity
1966-1968	Wastes are disposed of at Rose Township site
April 1979	Michigan Department of Natural Resources (MDNR) surveys site
June 1979	Drums sampled by MDNR
July 1980	5,000 drums removed from site by MDNR
1982	Site placed on NPL
February 1984-September 1987	MDNR performs Remedial Investigation and Feasibility Study
September 1987	Record of Decision signed
September 1992	Trial burn conducted
September 1992	Excavation and incineration operations begin
October 1993	Incineration operations completed

SITE INFORMATION (CONT.)

Site Information

- The Rose Township site occupies 110-acres on Demode Road in rural Rose Township, Michigan. Located approximately 1 mile west of the town of Rose Center, the site comprises an upland area almost completely surrounded by wetlands with an abundance of wildlife on the site. The southern portion of the site is heavily wooded with hardwoods. The middle portion, a rolling meadow, is bordered by a marsh to the west and northeast and Demode road to the north.
- There are two groundwater contaminant plumes on-site. In the northern part of the site is a plume containing vinyl chloride, and in the southwest is a plume containing vinyl chloride, xylene, toluene, and benzene. The northern plume threatens to contaminate nearby domestic drinking-water wells, one of which is located within 1,600 feet of the site.

Site Logistics/Contacts

Site Management: EPA Region 5-lead

Oversight: Michigan Department of Natural Resources

Remedial Project Manager:
Kevin Adler
US EPA Region 5
77 West Jackson Boulevard
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Treatment System Vendor:
Greg McCartney
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16406 U.S. Route 224 East
Findlay, OH 45840

MATRIX DESCRIPTION

Matrix Identification

Type of Matrix Processed Through the Treatment System: Soil, rocks, and tree stumps

Contaminant Characterization

Primary Contaminant Groups: PCBs, metals, and volatile and semivolatile organic compounds.

- During the RI, contaminants detected in the soil included PCBs at concentrations up to 980 mg/kg. Lead was detected at concentrations up to 3,200 mg/kg. A variety of other volatile and semivolatile organic compounds also were detected in soils during the RI. The most common contaminants and their respective maximum concentrations were toluene (4,700 mg/kg), ethylbenzene (430 mg/kg), chlorobenzene (570 mg/kg), xylene (1,400 mg/kg), naphthalene (31 mg/kg), pentachlorophenol (32 mg/kg), acetone (76 mg/kg), and total phthalates (91 mg/kg).

MATRIX DESCRIPTION (CONT.)

Matrix Characteristics Affecting Treatment Costs or Performance

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

Table 2. Matrix Characteristics [4]

Parameter	Value[1]	Measurement Procedure
Percent Moisture	13.1 - 14.2	SMEWW[2] 209F
Heat Content	<200 - 1,310 BTU/lb	ASTM[3] D240-76

[1] The value given is the range of values found in soils incinerated during the trial burn. Information on matrix characteristics for the full-scale incineration is not currently available.

[2] SMEWW - Standard Methods for the Examination of Water and Waste, 17th Edition, 1989.

[3] ASTM - American Society for Testing and Materials, 1985 edition.

TREATMENT SYSTEM DESCRIPTION

Primary Treatment Technology

Incineration system including: OHM Mobile Infrared Thermal Destruction Unit, including:

- Waste feed handling system
- Infrared incinerator
- Secondary combustion chamber

Supplemental Treatment Technology

Pretreatment (solids):
- Screening
- Drying
- Blending
- Crushing/shredding (rocks/debris)

Post Treatment (air):
- Quench
- Low-energy venturi scrubber
- Packed-column chemical scrubber
- High-energy venturi scrubber

Post Treatment (water):
- Clarification
- Sand filtration
- Bag filtration
- Activated carbon adsorption
- Ion exchange

TREATMENT SYSTEM DESCRIPTION (CONT.)

System Description and Operation

- Soil was excavated from the Rose Township Site using backhoes and longarms. Excavated materials were screened to remove debris greater than 1 inch in diameter using a portable three-tiered screen. Wet soils were dried before screening in a drying building to prevent clogging of the screen.

- Drying was conducted on the site in a building equipped with heaters and blowers. Excavated material that required drying was placed in the building and periodically mixed with a frontend loader or tractor equipped with a rototiller. Soil was also screened in the building following drying.

- Screened soils were blended with fuel oil or diesel fuel to raise its heat content to approximately 500 BTU/lb.

- Debris such as rocks and tree stumps screened out of the soil were stored separately for further processing. Rocks were crushed using a mobile crusher and tree stumps were shredded in a tub grinder. Both the rocks and tree stumps were reduced to less than one inch diameter and incinerated along with shredded personal protective equipment.

- Intact drums unearthed during the excavation were sampled and analyzed to determine their contents and disposed of off the site at approved facilities.

- Material to be incinerated was loaded into a feed hopper, from which it was discharged onto a weigh belt feeder. The material then dropped from the weigh belt feeder to an enclosed conveyor belt, where it was leveled as it passed under a screw. The material then dropped from the conveyor belt to a high temperature metal alloy belt that conveyed it through the primary combustion chamber.

- In the primary combustion chamber material was heated with infrared radiant heat generated by silicon carbide heating elements. Ash and off-gases were then discharged from the primary combustion chamber.

- Ash from the primary chamber dropped on to an enclosed, water-cooled screw conveyor. Ash discharged from the screw was sprayed with water to suppress dust and for additional cooling. Ash that contained greater than 1 mg/kg PCBs was incinerated again; approximately 600 tons of material was incinerated again. Ash that exceeded the extraction procedure (EP) toxicity test threshold of 5 mg/L for lead or arsenic was stabilized. All ash that met the treatment criteria, including ash that was incinerated or stabilized, was disposed of on site.

- The primary combustion chamber residence time was required to be greater than 15 minutes for incineration at the Rose Township Site. The incinerator feed rate was limited to less than 13,800 lb/hr.

- The maximum heat input to the primary combustion chamber from the silicon-carbide heating elements was 3,412,000 BTU/hr. The primary combustion chamber was capable of operating at temperatures up to 1,800°F, and was required to be operated at the site at temperatures greater than 1,400°F. Within the primary combustion chamber the material was stirred by cake-breakers powered by 1/2 horsepower (hp) motors.

- Primary combustion chamber gas flowed counter-current to the material being incinerated. Combustion air was provided by an forced draft blower manufactured by Buffalo Forge Company, Model No. 270, type BL.

TREATMENT SYSTEM DESCRIPTION (CONT.)

System Description and Operation (Cont.)

- Off-gas from the primary combustion chamber entered the SCC for further destruction. The SCC was 96 feet, 10 inches long and had an internal height of 8 feet, internal width of 7 feet, and internal volume of 3,770 cubic feet. The SCC was fired by 4 Multifire® natural gas burners, Model No. 31534, manufactured by Maxon Corporation, Muncie, Indiana. Integral to the burner system was a 20 hp forced air blower capable of providing 32 inches of water column pressure. The burner system had a maximum firing capacity of 12,020,000 BTU.

- The SCC was designed to operate at temperatures up to 2,400°F, and was required to operate at greater than 1,950°F at the Rose Township Site.

- Excess combustion air was provided in the SCC by a blower manufactured by the Chicago Blower Corporation, Model 24-1/2 SQAD, with a maximum capacity of 14,000 acfm.

- Gas exiting the SCC was quenched with a water spray that reduced its temperature to less than 250°F.

- The off-gas from the quench was then routed to a low-energy venturi scrubber to remove particulates. Water was injected into the venturi scrubber at a rate of 140 gallons per minute (gpm), and the pH in the venturi scrubber was controlled by the addition of a 10% caustic solution. The off-gas was then sent to a packed column chemical scrubber.

- The packed column chemical scrubber removed acid gas by passing the gas through 260 cubic feet of 3.5-inch Jeager Tripack polyethylene packing. Water at a flow rate of greater than 150 gpm was passed through an overhead distribution plate onto the packing to scrub the gas. The pH of the packed column was controlled by the addition of a 10% caustic solution.

- The off-gas then was sent to a high-energy venturi scrubber to remove particulates and heavy metals. Water was injected into the scrubber at a rate of 140 gpm; a pressure drop of 55 to 65 inches of water column was maintained across the scrubber.

- After passing through the high-energy venturi scrubber, the gas was passed through 4 banks of high efficiency Munter Chevron mist eliminators, and then to an exhaust stack with an inside diameter of 32 inches and a height of 37 feet. Two induced draft fans maintained a negative pressure in the system. One fan was a Robinson Industries Model No. 70x3.5 RBD-SWSI, which could draw 30,000 acfm at 190°F, induced a pressure of 45 inches water column, rotated at a speed of 1,780 rpm, and was powered by a 200 hp motor. The second fan was a Robinson Industries Model No. 57x3.5 RBD-SWSI, which could draw 30,000 acfm at 190°F, induced a pressure of 35 inches water column, rotated at a speed of 1,780 rpm, and was powered by a 200 hp motor.

- Wastewater generated by the scrubbers and mist eliminators was treated on the site with a system consisting of clarification, sand filtration, bag filtration, activated carbon adsorption, and ion exchange. After treatment the water was discharged under a NPDES permit.

- The health and safety plan developed for the Rose Township Site required level C personal protective equipment in the soil drying building.

- Figure 1 shows a simple block diagram of the incineration system.

TREATMENT SYSTEM DESCRIPTION (CONT.)

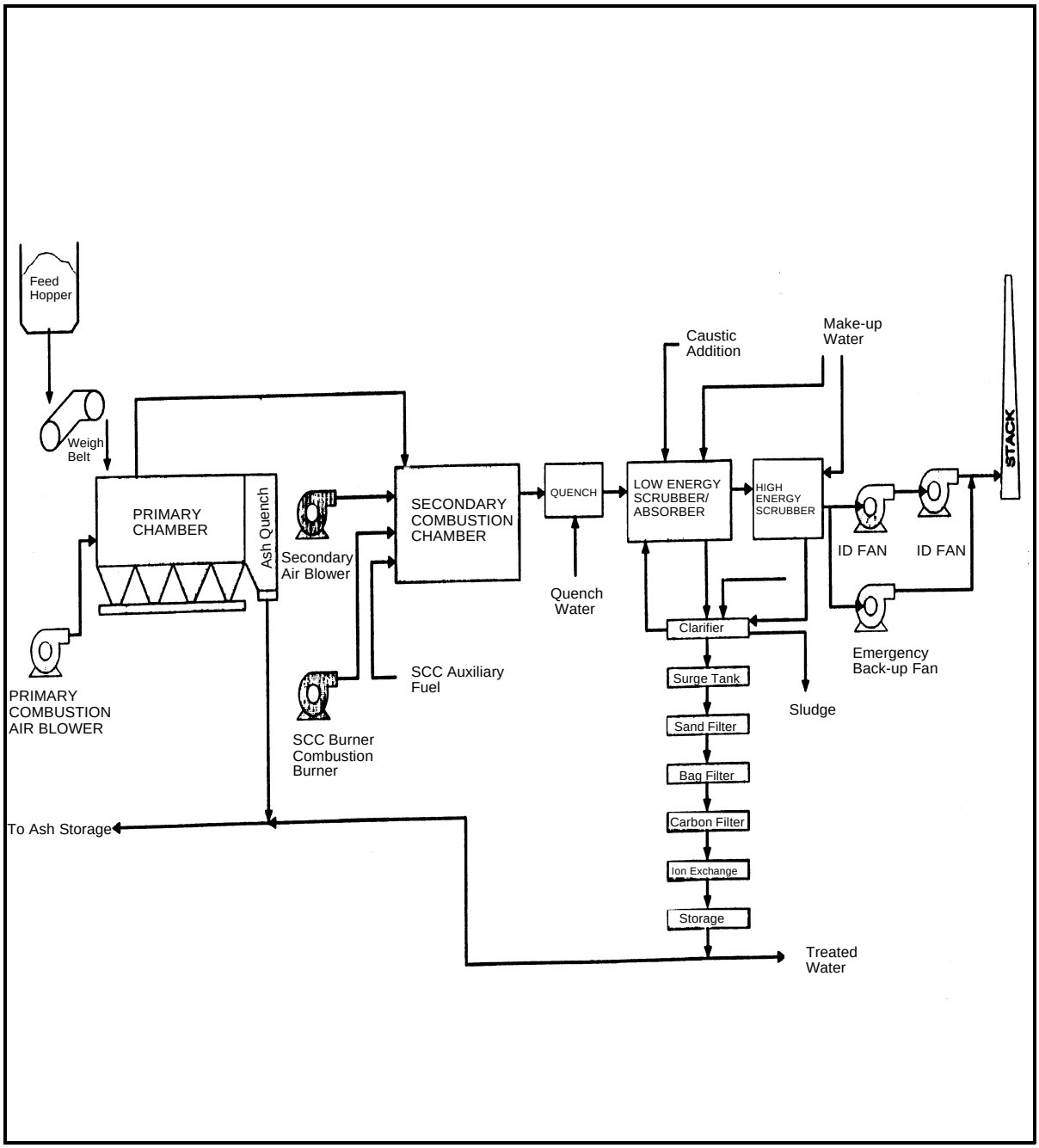

Figure 1. Block Diagram of Incineration System used at the Rose Township Dump Superfund Site

TREATMENT SYSTEM PERFORMANCE

Cleanup Goals/Standards

- The cleanup goals and standards were specified in the ROD. The DRE and ash management standards for metals were based on the regulations under Resource Conservation and Recovery Act (RCRA) (40 CFR 264.343 for the DREs and 40 CFR 261.24 for ash residuals). The DRE standards for PCBs were based on the Toxic Substances Control Act (TSCA)(40 CFR part 761).
- The ROD established target cleanup levels of 10, 70, 14, and 0.08 mg/kg for PCBs, lead, arsenic, and total VOCs, respectively. The ROD specified on-site incineration of all soil contaminated with either organics or PCBs. However, a consent decree signed in 1988 by 12 PRPs required incineration of PCB-contaminated soil and an alternate remediation for soil contaminated with organics only. Therefore, a soil target cleanup level was not established for semivolatile organic compounds in incinerated soil.
- The DRE requirements for the incinerator were set at 99.9999% for PCBs. The metals emissions requirements were based on EPA guidance and Michigan Act 348.
- The incinerator ash was required to contain less than 1 mg/kg PCBs prior to disposal on-site.

Treatment Performance and Compliance

- A trial burn, conducted on September 11 and 12, 1992, was designed to operate the incineration system at conditions that would reflect worst-case destruction and removal of all constituents of concern. Samples of all influent and effluent streams during operation at these conditions were collected during the trial burn. These samples were then analyzed to determine whether all of the incinerator operating standards were met. Operating limits were then set based on the worst-case values that were established during the trial burn.
- Because of the detection limit used for PCBs, and the low concentrations of PCBs in soils at the Rose Township Site, it was not possible to demonstrate a 99.9999% DRE. However, the incineration unit employed at the Rose Township site had been issued a TSCA permit for the incineration of contaminated soils, based on a trial burn conducted in June of 1988 at another site. EPA determined that demonstration of a 99.9999% DRE for PCBs was not necessary during the trial burn because (1) substantial hazards were associated with transporting and storing concentrated PCB oils, and (2) the unit had demonstrated the ability to adequately destroy PCBs in order to obtain its TSCA permit.

TREATMENT SYSTEM PERFORMANCE (CONT.)

Treatment Performance and Compliance (Cont.)

- During the trial burn, the incinerator demonstrated its ability to meet the emission standards specified in its TSCA permit for the incineration of PCB-contaminated soils, and the Michigan Act 348 metals and PCB emissions standards.
- Soil excavated from areas on site that was known to be contaminated with PCBs, lead, and arsenic was incinerated during the trial burn. Before incineration the soil was blended with fuel oil or diesel fuel to achieve a minimum heat content of 500 BTU/lb.
- During the trial burn conducted in June 1988 as part of the procurement of a TSCA PCB incineration permit for the incinerator, a 99.9999 % DRE was demonstrated on waste feed containing 5,600 mg/kg of PCBs. This information was deemed sufficient by EPA to demonstrate compliance at the site. The DRE for PCBs was calculated by the PRP, and this information is shown in Table 3.
- The incineration system included continuous emissions monitors (CEMs) for carbon monoxide, carbon dioxide, oxygen, and total hydrocarbons. The stack operating data for the CEMs during the trial burn were used to set ranges for normal operating conditions. The CEMs were employed during the normal operations of the incinerator to ensure that operating conditions remained within the bounds established during the trial burn.
- The incineration system also included an automatic waste feed cutoff (AWFCO) system to suspend operations if the operating conditions were not within the proper ranges set by the trial burn. The AWFCO limits used during the remedial action are shown in Table 4. Information about the frequency of AWFCOs was not available.
- Trial burn and typical operating parameters are shown in Table 5.
- The incinerator operated at the Rose Township Site operated predominantly within the operating limits established during the trial burn.
- The residual ash was sampled and analyzed using the EP toxicity test for lead and arsenic to determine whether these parameters met the requirements specified in the ROD for on-site disposal as backfill. The ROD required ash that failed to meet the requirements for leachable metals to be stabilized before land disposal. No ash required stabilization before land disposal.
- Initially some of the incinerated soil at the site did not meet the cleanup goal of less than 1 mg/kg PCBs. This was attributed to the fact that the size of the material being fed to the incinerator was too large. As a result, approximately 600 tons of material required reincineration. All subsequent feed to the incinerator was screened to less than 2 inches in diameter. No material required reincineration after the institution of such screening. The DRE was met for PCBs and metals.

Table 3. Average Destruction and Removal Efficiencies from Trial Burn Compliance Testing [3]

Contaminant	Average Contaminant Feed Rate in Soil (g/hr)	Average Contaminant Stack Gas Emissions Rate (g/hr)	Average Contaminant Concentration in Ash (mg/kg)	DRE (%)
PCBs	1,049	0.00131	120	99.99982

TREATMENT SYSTEM PERFORMANCE (CONT.)

Table 4. Automatic Waste Feed Cutoffs [4,6]

Parameter	Cutoff Limit
Secondary Chamber Temperature	<1950°F, >2,500°F
Secondary Chamber Excess Oxygen Level	<3%
Stack Carbon Monoxide Concentration	> 90 ppm with 2 minute delay, >150 ppm instantaneous
Primary Belt Failure	NA
Primary Chamber Pressure	<0.00 inches w.c.
Ash Cooling Conveyor Failure	Not Applicable
Induced Draft Blower Failure	Not Applicable
Stack Temperature	>250°F
Scrubber Quench Temperature	>250°F
Leveling Screw Failure	Not Applicable
Primary Chamber Zone A2 Temperature	<1,400°F
Primary Chamber Zone B2 Temperature	<1,530°F
High-Energy Venturi Pressure Drop	<20 inches w.c.
Scrubber pH	<4 s.u.

NA = Not Available
s.u. = Standard units
w.c. = Water column

Table 5. Operating Parameters [6, 9]

Parameter	Actual Value	Trial Burn Value
Primary Combustion Chamber Zone A2 Temperature	>1,400°F	1,523 - 1,543°F
Primary Combustion Chamber Zone B2 Temperature	>1,530°F	1,624 - 1,651°F
Primary Combustion Chamber Pressure	<0.0 inches w.c.	NA
Secondary Combustion Chamber Temperature	>1,950°F	2,025 - 2,048°F
Secondary Combustion Chamber Excess Oxygen	>3%	6.125 - 6.51 %
Stack Carbon Monoxide	<90 ppm	2.79 - 3.34 ppm
Stack Gas Flow Rate	<6,180 dscm	4,958 - 5,411 dscm
Scrubber pH	>6.0	6.41 - 6.87
Low-Energy Venturi Pressure Drop	>8 inches w.c.	11.42 - 11.96 inches w.c.
High-Energy Venturi Pressure Drop	>45 inches w.c.	52.98 - 56.4 inches w.c.
Waste Feed Rate	<13,800 lb/hr	13,092 - 13,937 lb/hr
Primary Combustion Chamber Retention Time	>15 minutes	NA

w.c. = Water column

OBSERVATIONS AND LESSONS LEARNED (CONT.)

Performance Data Completeness

- Data are available for concentrations of contaminants in the soil before incineration. Confirmatory soil samples were collected by the vendor after the remediation was completed.
- Data are also available for concentrations of contaminants in the incinerator residue. These data were collected periodically prior to landfilling. In addition, emissions data are available from the incinerator compliance test.

TREATMENT SYSTEM COST

Procurement Process

- The PRP contracted with Perini Environmental to acquire and operate the incinerator at the Site. Perini Environmental used several subcontractors to implement specific aspects of the operation.

Cost Data

- The total cost for operation of the incineration system was approximately $12,000,000. A total of 34,000 tons of soil, rocks, and tree stumps were incinerated. This corresponds to a total unit cost for incineration of $350 per ton. A detailed breakdown of these costs was not available.

OBSERVATIONS AND LESSONS LEARNED

Cost Observations and Lessons Learned

- Substantially more soil required incineration than anticipated, which resulted in increased costs. Based on the results of the RI/FS, 9,000 to 13,000 cubic yards of soil were estimated to require incineration. However, verification sampling during excavation indicated additional soil required incineration in order to meet cleanup goals, and 18,000 cubic yards of soil were ultimately incinerated at the Rose Township Site.

Other Observations and Lessons Learned

- Soil screening was hindered in wet weather because soil formed clumps that would not pass through the screening equipment. A drying building equipped with heaters and blowers was constructed to dry the soil before screening.
- The incinerator was shut down periodically to replace broken or damaged heating elements and for repairs to the conveyor belt. Replacement of the main conveyor belt required a 3-day shut down at one point during the project. No cause of these failures was identified by site personnel.
- Several times during the project the incinerator had to be shut down to remove fly ash that had slagged in the duct between the primary and secondary combustion chambers and in the secondary combustion chamber.
- Other operational problems included ash discharge system malfunction, loss of flame in the secondary combustion chamber, temporary loss of power, and weigh belt feeder malfunction.

OBSERVATIONS AND LESSONS LEARNED (CONT.)

Public Involvement

- The public comment period for the RI/FS commenced on June 29, 1987 and ended on August 12, 1987. A public meeting was held on July 1, 1987 to discuss the RI/FS and to present the proposed remediation plan. During the public meeting, no significant opposition was raised against the proposed plan. The public was generally supportive of the proposed plan as they wished the source of the contamination to be removed.

REFERENCES

1. Emissions Verification Test Plan, OHM Remediation Services Corp., Findlay, Ohio, June 12, 1992.
2. EPA National Priorities List, Rose Township Dump Fact Sheet, USEPA Region V, February, 1996.
3. Final Closure Report, Excavation and Incineration, Rose Township Site, Oakland County, Michigan. Perini Environmental Services, Inc., Framingham, Massachusetts, March, 1996.
4. Final Design Report, Thermal Treatment of PCB Laden Soils. Perland Environmental Technologies, Inc. April 1, 1992.
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