On-Site Incineration at the
Bridgeport Refinery and Oil Services Superfund Site
Logan Township, New Jersey

Incineration at the Bridgeport Refinery and Oil Services Superfund Site Logan Township, New Jersey

<table>
<tr><td>Site Name:
Bridgeport Refinery and Oil Services Superfund Site</td><td rowspan="2">Contaminants:
Polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), and metals
• benzene
• cadmium
• methylene chloride
• chromium
• toluene
• barium
• acetone
• zinc
• lead</td><td>Period of Operation:
December 1991 to January 1996</td></tr>
<tr><td>Location:
Logan Township, New Jersey</td><td>Cleanup Type:
Remedial action</td></tr>
<tr><td>Vendor:
ENSCO, Inc.</td><td rowspan="2">Technology:
On-site Incineration
• Incineration using direct-fired rotary kiln
• Screening and mixing of contaminated sediments prior to incineration
• Quenching of kiln ash in water bath
• Treatment of wastewater from system on-site and discharge to nearby creek
• Combustion of remaining VOCs and PCBs in secondary combustion chamber (SCC)</td><td>Cleanup Authority:
CERCLA
• ROD signed 1984
• EPA-lead, managed by U.S. Army Corps of Engineers</td></tr>
<tr><td>SIC Code:
NA</td><td>Point of Contact:
Don Lynch
U.S. EPA Region 2
290 Broadway
New York, NY 10007-1866
212-637-4419</td></tr>
<tr><td>Waste Source:
Lagoon Sediments--waste oil storage and reprocessing operations waste</td><td colspan="2" rowspan="2">Type/Quantity of Media Treated:

Lagoon sediments and sludges, debris, levee material, lagoon oil, and soil (172,000 tons)</td></tr>
<tr><td>Purpose/Significance of Application:
Inadequate design caused numerous mechanical problems; incineration operation suspended twice because of mechanical problems; problems with demulsifying complicated dewatering of sediment</td></tr>
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Incineration at the Bridgeport Refinery and Oil Services Superfund Site Logan Township, New Jersey

(Continued)

Regulatory Requirements/Cleanup Goals:

- Destruction and Removal Efficiency (DRE) of 99.99% for VOCs as required by Resource Conservation and Recovery Act (RCRA) incinerator regulations in 40 CFR Part 264, Subpart O; The DRE of 99.9999% for PCBs and ash residual as required by Toxic Substances Control Act (TSCA) regulations in 40 CFR Part 761

Results:

- Emissions and trial burn data indicate that all DRE and emission standards have been met

Description:

Between the 1960s and continuing through 1981, an on-site lagoon was used for disposal of wastes from waste oil reprocessing operations conducted on site. Lagoon sediment was contaminated with PCBs at concentrations greater than 500 mg/kg, as well as VOCs and metals.

In 1984, EPA signed a Record of Decision (ROD) specifying on-site incineration as the selected remedy for the sludge, sediment, soil, debris, and lagoon oil at the site. Remedial actions were managed by the U.S. Army Corps of Engineers (COE) under the oversight of EPA Region II.

The material to be incinerated was excavated from the lagoon, and screened and mixed before incineration. The material was then conveyed into a rotary kiln by a screw auger. The incineration system also included a secondary combustion chamber (SCC) to provide further destruction of any VOCs and PCBs. Kiln ash was quenched in a water bath. Wastewater from the incinerator was treated in an on-site wastewater treatment system and discharged to a nearby creek. Exhaust gas from the kiln was directed to an air pollution control system (APCS). The APCS consisted of a cyclone separator for removal of larger particulates; a secondary combustion chamber (SCC) for destruction of any remaining VOCs and PCBs.

During its 50 months of operation, the incinerator processed over 172,000 tons of sediment, sludge, debris, oil, and soils. Treatment performance and emissions data collected during this remedial action indicated that all performance standards and emissions requirements were achieved.

The actual cost for remediation using the incineration system was approximately $187,000,000 (includes costs associated with treatment of lagoon water and removal of tank farm).

EXECUTIVE SUMMARY

This report presents cost and performance data for the application of on-site incineration at the Bridgeport Rental and Oil Services Superfund Site (Bridgeport site) in Logan Township, New Jersey. A rotary kiln incinerator operated at the Bridgeport site from December 1991 through January 1996 as part of a remedial action.

Beginning in the 1960s and continuing through 1981, an on-site lagoon was used for disposal of wastes from waste oil reprocessing operations conducted on site. Lagoon sediment was contaminated with PCBs at concentrations greater than 500 mg/kg, as well as VOCs and metals.

Because responsible parties could not be identified quickly enough to adequately address threats to human health and the environment posed by the site, EPA initiated remedial actions at the site. In 1984, EPA signed a Record of Decision (ROD) specifying on-site incineration as the selected remedy for the sludge, sediment, soil, debris, and lagoon oil at the Bridgeport site. Performance standards for the incineration included a destruction and removal efficiency (DRE) of 99.9999% for PCBs and 99.99% for VOCs [2].

Remedial actions were managed by the U.S. Army Corps of Engineers (COE) under the oversight of EPA Region II. The material to be incinerated was excavated from the lagoon, and screened and mixed before incineration. The material was then conveyed into a rotary kiln by a screw auger.

The incineration system also included a secondary combustion chamber (SCC) to provide further destruction of any VOCs and PCBs. Kiln ash was quenched in a water bath. Wastewater from the incinerator was treated in an on-site wastewater treatment system and discharged to a nearby creek.

Exhaust gas from the kiln was directed to an air pollution control system (APCS). The APCS consisted of a cyclone separator for removal of larger particulates; a waste heat recovery boiler to reduce the temperature of the SCC exit gas; a venturi quench to further cool the gas stream, start the gas absorption process, and remove some of the entrained solids; a packed tower for additional scrubbing; and an educator scrubber for removal of acid fumes. Dust removed by the cyclone separator was discharged to the kiln ash quench.

During its 50 months of operation, the incinerator processed over 172,000 tons of sediment, sludge, debris, oil, and soils. Treatment performance and emissions data collected during this remedial action indicated that all performance standards and emissions requirements were achieved.

Detailed cost information was not available for on-site incineration at the Bridgeport site. The actual cost for remediation at the site was approximately $187 million. This figure includes costs associated with treatment of lagoon water and removal of the tank farm.

SITE INFORMATION

Identifying Information

Bridgeport Rental and Oil Superfund Site
Logan Township, New Jersey

CERCLIS #: NJD053292652

ROD Date: December 31, 1984

Treatment Application

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

Period of operation: December 1991-January 1996

Quantity of material treated during application: 172,000 tons, including 138,350 tons of lagoon sediment and sludge, 13,000 tons of debris, 12,550 tons of levee material, 3,850 tons of lagoon oil, and 4,250 tons of soil.

Background

Historical Activity that Generated Contamination at the Site: Waste oil storage and reprocessing

Corresponding SIC Code: NA

Waste Management Practice That Contributed to Contamination: Waste disposal in an on-site lagoon

Site History:

- The Bridgeport site occupies a 30-acre parcel of land which includes a 13-acre waste oil and wastewater lagoon, and a tank farm consisting of 90 tanks and process vessels.
- The lagoon was used for the disposal of wastes from on-site waste oil reprocessing and storage performed on site from the 1960s through 1981. The tank farm was used for waste oil storage and recovery.
- The lagoon depth reached 21 feet in some areas, with the bottom 13 feet in contact with groundwater. The volume of contaminants disposed of in the lagoon is not known.
- In the early 1970s, the eastern dike of the lagoon was breached, contaminating 3 acres of land with waste oils. The remedial action that is the subject of this report did not include soil from this 3-acre area.
- In the spring of 1981 the liquid level began to rise in the lagoon and threatened to overflow the dike for the lagoon. The U.S. Coast Guard increased the height of the dike by 5 feet.
- In the spring of 1982 and again in the spring of 1983 the liquid level in the lagoon rose and liquids threatened to overflow the lagoon's dike. During those two periods, EPA initiated emergency response actions at the site. These actions consisted of reducing the level of liquids in the lagoon by pumping the aqueous phase through a mobile activated carbon system and discharging the treated water to a nearby stream under a National Pollutant Discharge Elimination System (NPDES) Permit. The lagoon level was reduced by approximately 2 feet in each instance.

SITE INFORMATION (CONT.)

Background (Cont.)

- In late 1983 and early 1984, under an initial removal action at the site, EPA reduced the level of liquids in the lagoon by 8 feet by pumping the aqueous phase through a treatment system consisting of oil/water separation, flocculation/sedimentation, sand filtration, and granular activated carbon adsorption.

- A Phase I Remedial Investigation/Feasibility Study (RI/FS) was completed by EPA in 1984 to determine the nature and extent of soil contamination caused by operations related to the lagoon and tank farm and to evaluate remedial alternatives for these two areas of contamination. A Phase II RI/FS was initiated in September 1988 to determine the extent of groundwater contamination and to evaluate remedial alternatives for the groundwater and any remaining hazards posed by the site. Work to date has been performed by EPA; however, due to negotiations between EPA and the Potentially Responsible Parties (PRPs), work on the Phase II RI/FS has been suspended.

- Based on the results of the Phase I RI/FS, a ROD was signed on December 31, 1984 specifying remediation through excavation and on-site incineration of contaminated sludge, sediment, soil, debris, and oil from the lagoon and tank farm. The ROD specified that contaminated areas would be excavated until the material removed was no longer visibly contaminated with oil, followed by additional sampling to determine the need for additional excavation to meet cleanup goals.

- A trial burn was conducted in March and April of 1991, which demonstrated that the on-site incinerator could meet the performance requirements specified in the ROD.

- The incineration took place from December 1991 through January 1996 Contaminated material treated by incineration at the Bridgeport site included sludge and sediments from the lagoon, the oil on the surface of the lagoon, lagoon levee material, drums and debris excavated from the lagoon, and soil surrounding the lagoon.

Regulatory Context:

- In 1983 the Bridgeport site was placed on the National Priorities List (NPL).

- Because responsible parties could not be identified before a response was necessary to protect human health and the environment, no cooperative agreements for remedial actions at the Bridgeport site were reached for the early actions.

- The ROD signed in 1984 mandated that the lagoon sediments and sludge be removed until there was no evidence of oil staining in soils below the sludge layer.

- The selected remedy is consistent with 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 was technically feasible, reliable, and provided adequate protection on human health and the environment. EPA also determined that on-site incineration was the lowest cost alternative that provided a solution to the problems and potential problems posed by the Bridgeport site [4].

SITE INFORMATION (CONT.)

Timeline

Table 1. Timeline

Date	Activity
1960-1981	Lagoon used for waste disposal at the Bridgeport site
1981	U.S. Coast Guard emergency response increases height of lagoon dike 5 feet
1982	EPA emergency response reduces lagoon liquid level 2 feet
1983	Site placed on NPL
1983	EPA emergency response reduces lagoon liquid level 2 feet
1983-1984	EPA initial remedial action reduces lagoon liquid level 8 feet
1983-1984	EPA performs Phase I RI/FS
December 31, 1984	Record of Decision signed
March-April 1991	Trial Burn
November 1991	Excavation and incineration operations begin
January 1996	Incineration operations completed
September 1996	Site restoration and demobilization activities completed

Site Logistics/Contacts

Site Management: EPA-lead

Mark Wheeler
U.S. Army Corps of Engineers
609-241-1673

Oversight: EPA Region2

Remedial Project Manager:
Don Lynch
US EPA Region 2
290 Broadway
New York, NY 10007-1866
212-637-4419

Treatment System Vendor:
ENSCO, Inc.
Address: NA
NA

MATRIX DESCRIPTION

Matrix Identification

Type of Matrix Processed Through the Treatment System: Lagoon sediments and sludges, debris, levee material, lagoon oil, and soil.

MATRIX DESCRIPTION (CONT.)

Contaminant Characterization

Primary Contaminant Groups: Material incinerated at the Bridgeport Site was contaminated with PCBs, VOCs, and metals.

- The contaminants of greatest concern were PCBs, benzene, methylene chloride, toluene, acetone, lead, cadmium, chromium, barium, and zinc.
- Lagoon sediment contained PCBs at concentrations over 500 mg/kg; VOCs including benzene, methylene chloride, and toluene at concentrations up to 1 mg/kg; and acetone at levels up to 70 mg/kg. In addition, metals, including lead, cadmium, chromium, barium, and zinc were found at the site.

Matrix Characteristics Affecting Treatment Costs or Performance

Information on matrix characteristics such as soil density, particle size, and soil moisture content was not available.

TREATMENT SYSTEM DESCRIPTION

Primary Treatment Technology

ENSCO Modular Waste Processor (MWP)-2001 Rotary kiln Incineration System, including:

- Waste feed handling system
- Rotary kiln incinerator
- Secondary combustion chamber

Supplemental Treatment Technology

Pretreatment (solids):

- Screening
- Mixing

Post Treatment (air):

- Cyclone separator
- Venturi quench
- Packed tower scrubber
- Educator scrubber
- Demister
- Stack

Post Treatment (water):

- pH adjustment and clarification (scrubber wastewater)
- Oil/water separation, flocculation, sedimentation, sand filtration, and activated carbon adsorption (quench wastewater)

TREATMENT SYSTEM DESCRIPTION (CONT.)

System Description and Operation

- Soils and lagoon material lying above the groundwater table at the Bridgeport Site were excavated using backhoes and bulldozers. Lagoon sludge that was not mixed with debris was excavated using a barge- mounted hydraulic dredge. Sludge that contained too much debris to be effectively excavated by the dredge was removed by large land-based cranes and an amphibious excavator.

- Debris was separated from excavated material using a vibrating bar screen. Larger pieces of debris and unshreddable debris were removed and disposed of off-site. The remaining debris were shredded and incinerated.

- To provide a homogenous feed, material was mixed prior to incineration in ponds constructed on-site for this purpose.

- Material to be incinerated entered the rotary kiln at the flame end via screw auger, sludge lance, or ram feeder, then traveled through the kiln concurrent with the combustion gas. In the direct-fired rotary kiln, the PCBs and VOCs were volatilized and destroyed. Ash and exhaust gas were discharged from the kiln.

- Kiln ash was quenched in a water bath and then sent through a filter press. Ash was analyzed for heavy metals, a select list of organic compounds, and total PCBs. Ash that exhibited a characteristic of a hazardous waste for organic compounds or that contained greater than 2 mg/kg PCBs was incinerated a second time. Ash that exhibited a characteristic of a hazardous waste for metals was stabilized to remove the characteristic. Approximately 64,000 tons of ash were stabilized. All ash that met the treatment criteria, including ash that was retreated or stabilized, was then backfilled into the excavated lagoon.

- The rotary kiln had an inside diameter of 8.5 feet, an outside diameter of 10 feet, and a combustion chamber volume of 4,103 cubic feet. The kiln was limited to a throughput rate of 24 tons of contaminated material per hour.

- The kiln was designed to heat feed material to 1,200 to 1,400°F and combustion gas to 1,400 to 1,600°F. The kiln was heated by two 30 million BTU/hr Linde “A” burners fired with pure oxygen and fuel, and was designed to rotate at a rate of 1 to 2 rpm. The design residence time for solids in the kiln was 40 to 80 minutes.

- The off-gas from the kiln then was routed to the SCC, which provided further destruction of remaining contaminants. The SCC was 103 feet long and had an internal diameter of 6.5 feet. The SCC was equipped with a 30 million BTU/hr Linde “A” burner fired by an oxygen/fuel mixture. The SCC was designed to operate at a minimum temperature of 2,012°F and provide a minimum residence time of 2 seconds.

- Off-gas from the SCC passed through a duct equipped with a water spray header and a fire-tube boiler to reduce the exhaust gas temperature to approximately 500-700°F.

- Off-gas from the SCC was directed to a cyclone separator for removal of larger particulates. Particulate matter extracted from the exhaust gas fell to the bottom of the cyclone and was transported to the kiln ash quench bath.

- The off-gas was then passed to a venturi quench where water was sprayed into the gas stream to reduce the temperature to less than 190°F. The off-gas continued to the packed tower.

TREATMENT SYSTEM DESCRIPTION (CONT.)

System Description and Operation (Cont.)

- The packed tower removed any remaining particulate matter. The packed tower was 72 inches in diameter with space for as much as 10 feet of packing. The packing was continuously wetted by a water spray.
- Off-gas exited the packed tower to the inlet of an induced draft fan. The induced draft fan provided a negative pressure throughout the system to prevent fugitive emissions. From there the off-gas passed through a Hydrosonic® educator scrubber, a demister, and a stack. The educator was designed to remove additional acid fumes while the demister was designed to remove water vapor from the gas. Off-gas exited the stack with a temperature of 180 to 200°F and at a flow rate of 20,000 to 37,000 acfm.
- Scrubber water streams were recirculated through a sump which provided pH adjustment and clarification. During the remedial action at the Bridgeport Site, sump bottoms and quench solids were filter pressed and used as lagoon backfill on site. Quench water from the incinerator was treated in an on-site wastewater treatment system and discharged to a nearby creek.

TREATMENT SYSTEM PERFORMANCE

Cleanup Goals/Standards

- The cleanup goals and standards were specified in three documents: the ROD, the contract plans and specifications, and an incinerator "Permit Equivalency" document.
- The DRE and ash residual management standards for VOCs and metals were based on RCRA regulations (40 CFR § 264.343 for the DREs and 40 CFR § 261.24 for ash residuals). The DRE standards for PCBs were based on regulations issued under the Toxic Substances Control Act (TSCA) (40 CFR part 761).
- The ROD required that the lagoon sediments and sludge be removed until no oily soils were observed beneath the sludge layer. The ROD did not specify numerical limits for remedial action at the site, but required that sampling and analysis would be conducted once visibly contaminated material was removed. The sampling results were to be reviewed by EPA to determine whether removal of additional material was required.
- The DRE requirements for the incinerator were set at 99.9999% for PCBs and 99.99% for VOCs.
- For VOCs and metals, ash was subject to the Toxicity Characteristic Leaching Procedure (TCLP) test. The maximum permissible concentration of PCBs in the residual ash was set at 2 mg/kg. The maximum permissible concentrations of metals were the applicable regulatory threshold concentrations in 40 CFR § 261.24.

TREATMENT SYSTEM PERFORMANCE (CONT.)

Treatment Performance and Compliance

- The trial burn at the Bridgeport site, conducted from March 12 through April 7, 1991, was designed to operate the incineration system at conditions that would reflect worst-case destruction and removal of all constituents of concern.
- The POHCs selected for the trial burn were carbon tetrachloride and monochlorobenzene, which acted as surrogates for the VOCs found at the site.
- Soil excavated in the tank farm area and clean fill material from off-site were used as incinerator feed in the trial burn. Known quantities of PCBs (in trichlorobenzene), POHCs (carbon tetrachloride and monochlorobenzene), and a metals slurry (arsenic trioxide, calcium oxide, and a potassium dichromate) were spiked into the incinerator feed. During the trial burn, concentrations of spiked contaminants in the waste feed and stack gas were measured. These data were used in conjunction with flow rate data to calculate a DRE for each of the spiked contaminants. The reported DRE for each of the spiked contaminants are included in Table 2. The DREs for the constituents of concern are assumed to be greater than those of the spiked contaminants.
- During the trial burn DREs exceeded 99.9999% for PCBs and 99.99% for monochlorobenzene and carbon tetrachloride. Metals removal percentages were in excess of 99% [3].
- AWFCO limits used during operation of the incinerator are shown in Table 4; information on the frequency of AWFCOs was not available. Trial burn and typical operating parameters are shown in Table 5.
- The incinerator at Bridgeport operated within the operating limits established during the trial burn, signifying that all cleanup requirements established in the ROD were met.
- The residual ash was tested by TCLP to see if it was in compliance with the on-site land disposal requirements. Data from the TCLP analyses were not available. Approximately 8,800 tons of ash were incinerated a second time because it failed to meet the PCB concentration requirement of less than 2 mg/L. Approximately 64,000 tons of ash were stabilized because they failed the TCLP test for heavy metals.

Table 2. Average Destruction and Removal Efficiencies and Removal Percentages from Trial Burn Compliance Testing [1]

Contaminant	Average Contaminant Feed Rate in Soil (g/hr)	Average Contaminant Rate in Stack Gas Emissions (g/hr)	Average Contaminant Concentrations in Ash (µg/L)	DRE (%)
PCB	35000	<0.0082	<0.0001	>99.99997
carbon tetrachloride	41000	<0.049	<10	>99.99989
monochlorobenzene	40000	<0.0048	NA	>99.99998
arsenic[a]	203	<0.14	<0.012	>99.92
cadmium[a]	189	0.56	<0.005	99.68
chromium[a]	2700	0.2	0.041	99.99

[a]This represents a removal percentage only and not a true DRE.

TREATMENT SYSTEM PERFORMANCE (CONT.)

Table 3. Automatic Waste Feed Cutoffs [2]

Parameter	Cutoff Limit
SCC Temperature	<2,066 deg. F
Kiln Exit Temperature - No Flame	Not applicable
Kiln Exit Temperature - With Flame	<1,200, >1,580 deg. F
Kiln Exit Draft	>-0.1 in w.c.
CO in Stack - 1 hour average	>100 ppmv
CO in Stack - 10 minute average	>500 ppmv
Oxygen in Stack	<3.5%
Steam Drum Level	<25%
Loss of Power	Not applicable
Loss of Induced Draft Fan	Not applicable
Loss of Water Flow To Quench Nozzle	Not applicable

N/A - Not Available

Table 4. Operating Parameters [2]

Parameter	Actual Value	Trial Burn Value
Contaminated Soil Feed Rate	<21,800,000 grams/hr	NA
Secondary Combustion Chamber Temperature	>2066 deg. F	NA
Secondary Combustion Chamber Residence Time	>2 seconds	NA
Kiln Exit Temperature	>1580 deg. F	NA
Arsenic in Feed	10 mg/kg	NA
Cadmium in Feed	10 mg/kg	NA
Chromium in Feed	130 mg/kg	NA
Lead in Feed	10,000 mg/kg	NA
Mercury in Feed	1 mg/kg	NA
Nickel in Feed	40 mg/kg	NA
Beryllium in Feed	1 mg/kg	NA
Maximum Allowable Emission Rate		
Particulate	2,600 grams/hr	332 grams/hr
Sulfur Dioxide	4,900 grams/hr	227 grams/hr
Nitrogen Oxide	11,400 grams/hr	NA
CO	4,500 grams/hr	NA
Hydrocarbon	1,400 grams/hr	NA
Arsenic	3.3 grams/hr	<0.14 grams/hr
Beryllium	1.6 grams/hr	<0.3 grams/hr
Chromium	2.6 grams/hr	0.2 grams/hr
Lead	522 grams/hr	1.6 grams/hr
Mercury	10.9 grams/hr	0.15 grams/hr
Nickel	3.9 grams/hr	0.31 grams/hr
PCBs	0.0045 grams/hr	<0.0082 grams/hr
HCl	1,800 grams/hr	35 grams/hr
Dioxins and Furans	0.000045 grams/hr	NA

TREATMENT SYSTEM PERFORMANCE (CONT.)

Table 4. Operating Parameters [2]

Parameter	Actual Value	Trial Burn Value
Benzene	10.9 grams/hr	NA
Carbon Tetrachloride	4.5 grams/hr	0.049
Chloroform	1.4 grams/hr	NA
Ethylene Dichloride	0.14 grams/hr	NA
1,1,2,2-Chloroethane	0.0045 grams/hr	NA
Tetrachloroethylene	3.6 grams/hr	NA
1,1,2-Trichloroethane	0.045 grams/hr	NA
Trichloroethylene	0.91 grams/hr	NA
Dioxane	0.045 grams/hr	NA
Ethylene Amine	0.045 grams/hr	NA
Ethylene Dibromide	0.045 grams/hr	NA

TREATMENT SYSTEM COST

No information was available on the costs of on-site incineration at the Bridgeport site.

OBSERVATIONS AND LESSONS LEARNED

Observations and Lessons Learned

- Significant difficulty was encountered excavating material from below the water table because of debris and structural instability of soils at the lagoon bottom. Large cranes with excavating buckets and an amphibious excavator were employed in addition to the barge-mounted, hydraulic dredge originally planned.

- Passage of heavy equipment over the site resulted in an oily material rising from underground up to the surface. Where this oily material surfaced, approximately 230 cubic yards of soil were excavated and incinerated. The resulting holes were backfilled with clean material from an off-site source.

- The sediment excavated from the lagoon could not be dewatered as originally anticipated. The sediment was an emulsified mixture of soil, water, and oil, and was difficult to demulsify. Sedimentation in ponds, flocculation with polymers, screening, and centrifugation were all attempted but did not show satisfactory separation of water. In addition, the properties of the sludge varied significantly. Ponds initially constructed for dewatering of sludge were used to mix the sludge to achieve some homogenization prior to incineration.

OBSERVATIONS AND LESSONS LEARNED (CONT.)

- Debris in the sediment caused problems and delays and made excavation of material more difficult than anticipated. Intact drums, large and unshreddable pieces of debris, and a large amount of municipal solid waste discovered during excavation of the lagoon were disposed off site. In addition, special handling was required of some intact drums that were found to contain sulfuric acid.

- The incinerator experienced a number of mechanical difficulties, including jams in the feed auger, jams in the incinerator ash auger, failure of the ash removal system at the ash quench, overpressurization of the kiln, induced draft fan failures, loss of boiler water, slag build-up in the kiln and secondary combustion chamber, and excursions outside permitted operating parameters. These problems resulted in reduced performance and down time.

- On one occasion, a release of ash to the atmosphere occurred when a slide gate became disengaged from the cyclone.

- Incineration was suspended in order to conduct repairs from February to April 1995 and again from July to August 1995.

REFERENCES

1. ENSCO MWP-2001, Trial Burn Report, March 12 through April 7, 1991. ENSCO, Inc., July 18, 1991.

2. Operable Unit Remedial Action Report, Lagoon and Project Site Cleanup, Bridgeport Rental and Oil Services Site. U.S. EPA Region II. Undated.

3. Remedial Action Update, Bridgeport Rental and Oil Services. U.S. EPA Region II. February 5, 1996.

4. Superfund Record of Decision, Bridgeport Rental and Oil Services Site, Logan Township, New Jersey, December 31, 1984.

5. USEPA National Priorities List, Bridgeport Rental and Oil Services Fact Sheet. U.S. EPA, August 1996.