On-Site Incineration at the
Times Beach Superfund Site
Times Beach, Missouri

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<table>
<tr><td>Site Name:
Times Beach Superfund Site</td><td rowspan="2">Contaminants:
Dioxins
• 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) in soil and debris
• TCDD concentrations up to 1,800 µg/kg</td><td>Period of Operation:
March 1996 to June 1997</td></tr>
<tr><td>Location:
Times Beach, Missouri</td><td>Cleanup Type:
Remedial action</td></tr>
<tr><td>Vendor:
Con Murphy
International Technology Corporation
97 North Outer Road, Suite 8
Eureka, MO 63025
(314) 938-9711</td><td rowspan="2">Technology:
On-Site Incineration
• Solids pretreated by shredding, screening, and mixing with lime
• Incineration system consisting of rotary kiln and secondary combustion chamber (SCC)
• Enclosed conveyor transported contaminated soil and debris to the unit
• Soil residence time of 1 hour, kiln temperature of 1,250°F, SCC temperature of 1,750°F
• Treated soil and debris (incinerator ash) discharged into cooler, where it was sprayed with water</td><td>Cleanup Authority:
CERCLA and State: Missouri
• ROD Date: 9/29/88
• PRP-lead</td></tr>
<tr><td>SIC Code:
2834 (Pharmaceutical Preparations)</td><td>Point of Contact:
Robert W. Feild
Remedial Project Manager
U.S. EPA Region 7
726 Minnesota Avenue
Kansas City, KS 66101
(913) 551-7697</td></tr>
<tr><td>Waste Source:
Road Oiling - Application of TCDD-containing waste oils to roadways for dust control</td><td colspan="2" rowspan="2">Type/Quantity of Media Treated:
Soil and Debris
• 265,000 tons of soil and debris
• Moisture content: soil - geometric mean value of 7.8%</td></tr>
<tr><td>Purpose/Significance of Application:
Incinerator acts as the sole treatment unit in the State of Missouri for TCDD-contaminated soil and debris; system treated soil and debris from 27 sites</td></tr>
<tr><td colspan="3">Regulatory Requirements/Cleanup Goals:
• On-site Soil - Background concentrations of 20 µg/kg or less
• Destruction and Removal Efficiency (DRE) of 99.9999% for TCDD as required by Resource Conservation and Recovery Act (RCRA) incinerator regulations in 40 CFR part 264, subpart O</td></tr>
<tr><td colspan="3">Results:
• Emissions and trial burn data indicate that all DRE and emission standards have been met
• 1,900 tons of incinerator ash required re-incineration because it did not meet landfilling criteria
• Analytical data of residuals (including re-incinerated ash) indicate that cleanup goals have been met thus far</td></tr>
</table>

Incineration at the Times Beach Superfund Site
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(Continued)

Description:
Between 1970 and 1972, a pharmaceutical and chemical company produced wastes that contained TCDD from the production of hexachlorophene. A waste oil company mixed this waste with waste oil and used the mixture to spray roads in Times Beach and the surrounding areas to control dust. A remedial investigation determined that soil was contaminated at 27 sites in the State of Missouri; Times Beach served as a central treatment facility for these sites. A Record of Decision (ROD), signed in September 1988, specified on-site incineration as the remediation technology for the excavated soil and debris. Site cleanup goals and DRE standards were specified for TCDD.

On-site incineration using the IT Corporation Hybrid Thermal Treatment System® began in March 1996 and was completed in June 1997. The treatment system consisted of a rotary kiln and an SCC. An enclosed conveyor moved the soil and debris to the kiln for treatment. Treated ash from the incinerator was discharged to a cooler where it was quenched with water. During its operation, the incinerator at Time Beach processed 265,000 tons of soil and debris. Incineration achieved the soil cleanup goals specified in the ROD, including 1,900 tons of incinerator ash that met soil cleanup goals only after re-incineration.

The total cost of the Remedial Action was approximately $110,000,000.

EXECUTIVE SUMMARY

This report presents cost and performance data for the application of on-site incineration at the Times Beach Superfund site in Times Beach, Missouri. A rotary kiln incinerator was operated from March 1996 through June 1997 as part of a remedial action. The contaminant of concern at the site was 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD).

The Times Beach site served as a central incineration facility for 27 TCDD-contaminated sites across the state of Missouri. Soil and debris at these sites were contaminated with TCDD in the 1970s by waste generated in the production of hexachlorophene by a pharmaceutical and chemical company. This waste was mixed with waste oil and sprayed on roads as a dust suppressant by a private firm.

The contaminated debris from the 27 sites included home insulation, furniture, flooring, carpet, and mattresses; scrap metal; and tree stumps and brush. Contaminated soil contained rocks, asphalt, gravel, and sawdust [4]. The geometric mean of TCDD concentrations measured during the remedial investigation was 79 µg/kg.

In 1990, EPA and the State of Missouri entered into an agreement with the Responsible Party (RP). A Record of Decision (ROD) signed in September 1988 established a destruction and removal efficiency (DRE) of 99.9999% for TCDD.

The RP conducted remedial activities including the operation of the rotary kiln incinerator. The incineration system used at Times Beach was comprised of a solid waste feed system; a countercurrent, controlled-air, rotary kiln with an oxygen-enhanced burner; a secondary combustion chamber (SCC); a wet gas cleaning system (GCS); and a treated material handling system [4].

Soil and debris were collected in bags, drums, and boxes, and transported to the Times Beach incinerator. To prepare the feedstock, soil was mixed with lime to reduce moisture content and debris was shredded to an acceptable size for the incinerator. Prepared material was fed to the incinerator by an enclosed conveyor.

Resulting ash from the incinerator was removed and cooled with water, while off-gas was drawn into the SCC. The SCC was a down-fired steel shell that provided further combustion of contaminants in the off-gases. Both the incinerator and SCC were fueled by natural gas.

Treated gas was then drawn into the GCS, which consisted of a quench contactor, a gas conditioner, two Hydro-Sonic® scrubbers, and a vane separator. The GCS cooled the gas from the SCC and was designed to remove particulate matter, metals, and acid gases before discharge to the atmosphere. Ash collected from the incinerator and GCS was sampled and analyzed; if it met the treatment criteria it was landfilled on site. Ash that failed to meet criteria was re-incinerated.

During its 16 months of operation, the incinerator processed approximately 265,000 tons of contaminated material. Treatment performance and emissions collected during this application indicate that all performance standards and emissions were achieved.

The actual cost for remediation using the incineration system was approximately $110,000,000.

SITE INFORMATION

Identifying Information

Times Beach Superfund Site
Times Beach, Missouri

CERCLIS #: MOD980685226

ROD Date: September 29, 1988

Treatment Application

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

Period of operation: March 1996 - June 1997

Quantity of material treated during application: 265,000 tons of soil and debris

Background

Historical Activity that Generated Contamination at the Site: Production of hexachlorophene

Corresponding SIC Code: 2834 (Pharmaceutical Preparations)

Waste Management Practice That Contributed to Contamination: Oil used for roadside dust suppression

Site History:

- The Times Beach site occupies a 0.8 square mile area on the Meramec River. The site served as the central collection and treatment center for the 27 TCDD-contaminated sites in the state of Missouri.
- From April 1970 until January 1972, a pharmaceutical and chemical company generated TCDD-contaminated waste during the production of hexachlorophene.
- From February 1971 until October 1971, a waste oil company removed TCDD-contaminated still bottoms from the chemical plant and mixed it with waste oil. The town of Times Beach contracted the oil company to spray unpaved roads with waste oil to control dust from the summer of 1972 through the summer of 1976 [*10*].
- In July of 1971, drums of waste containing TCDD were buried at the Denney Farm site. An additional 225,000 gallons of waste were taken to the wastewater treatment school at Neosho. In October 1979, an anonymous caller tipped EPA that the waste was applied at various locations in Missouri including Minker, Stout, and Romaine Creek. Subsequent investigations found TCDD contamination at the Denney Farm site and other farms, the wastewater at Neosho, and in fish and sediment in the Spring River [*10*].
- A site investigation was conducted in the town of Times Beach in 1982. In February 1983, under the advice of the Center for Disease Control (CDC), EPA transferred funds to the Federal Emergency Management Agency (FEMA) to permanently relocate Times Beach residents and businesses [*2*].
- A Remedial Investigation and Feasibility Study (RI/FS) was conducted in 1984 for the Times Beach and Minker, Stout, and Romaine Creek sites. Based on the RI/FS, a ROD was signed in September 1988, specifying on-site incineration to reduce the concentration of TCDD in soil and debris.
- EPA determined that Times Beach was the best location for a temporary treatment facility for the TCDD-contaminated soil and debris from the various sites in the state of Missouri.

SITE INFORMATION (CONT.)

Background (Cont.)

- The RP began excavating the contaminated soil at all of the sites in 1992. Between 1992 and March 1996, the contaminated soil and debris were stored in temporary containment facilities. In March 1996, a mobile, rotary kiln incinerator began operation to remediate the excavated soil and debris.

- The RP incinerated approximately 240,000 tons of soil and debris between March 1996 and June 1997 [*12*].

Regulatory Context:

- The Missouri Department of Natural Resources (MDNR) and EPA identified site cleanup requirements described in a ROD signed on September 29, 1988 [2]. The ROD called for placing a clean soil cover at least 1 foot in depth over soil in the state that contained TCDD concentrations ranging from 1 to 20 µg/kg. Excavation and incineration was required for soil with concentrations exceeding 20 µg/kg.

- In 1990, the state of Missouri and EPA entered into an agreement with the PRP, which included remediation activities at the site in Times Beach, Missouri.

- The selected remedy was 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 [1].

- Hazardous Waste Management Facility/ RCRA Permit No. MO0000335919, issued by EPA and MDNR, signed on April 14, 1995, required a trial burn and a dioxin stack test and set requirements for air emissions from on-site incineration of contaminated soil and debris.

- Resource Conservation and Recovery Act (RCRA) regulations require a DRE of 99.9999% for TCDD. Stack gas monitoring was conducted for oxygen and carbon monoxide in accordance with 40 CFR part 264, subpart O.

Remedy Selection: On-site incineration was selected as the remedy for contaminated soil at the Times Beach Superfund site; wastes from 26 other sites in the State of Missouri also were incinerated at the site based on treatability study results, long-term economic concerns, and human health considerations.

SITE INFORMATION (CONT.)

Timeline

Table 1. Timeline [10]

Date	Activity
April 1970-January 1972	TCDD waste produced
July 1971	Waste buried at Denney Farm site
Summer 1972-Summer 1976	An oil company applied waste oil to unpaved streets of Times Beach
October 1979	225,000 gallons of waste taken to Neosho wastewater treatment school
October 1982	Initial site investigation completed
February 1983	EPA transfers funds to FEMA to permanently relocate residents and businesses
February 1986	Remedial Investigation/Feasibility Study completed
September 1988	Record of Decision signed
November 11, 13, 14, 1995	Trial Burn
1992	Contaminated soil excavation started at Times Beach and 26 other sites
March 1996 - June 1997	Rotary kiln incinerator is operational

Site Information

- Soil samples were collected at more than 1,000 different locations at the Times Beach site, at varying depths to characterize the extent of the contamination.
- Soil samples were also collected and analyzed at 26 other sites across the state to characterize the extent of contamination at these sites.

Site Logistics/Contacts

Site Management: RP-lead

Oversight: EPA

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MATRIX DESCRIPTION

Matrix Identification

Type of Matrix Processed Through the Treatment System: Soil and debris

- Excavated soil contained rock, asphalt, gravel, and sawdust.
- Debris included insulation, furniture, flooring, clothing, drapes, carpet, mattresses, plastic liners, rubble, trash, vinyl flooring, charcoal, water, metal scrap, brush, tree stumps, vacuum truck hoses, personal protective clothing, samples, and containers [4].

Contaminant Characterization

Primary Contaminant Group: Dioxins

- The contaminant of greatest concern is TCDD.
- The minimum and maximum concentrations detected in the state were 1 µg/kg and 1,800 µg/kg respectively, with a geometric mean value of 79 µg/kg.

Matrix Characteristics Affecting Treatment Costs or Performance

- The soil treated at Times Beach had a moisture content that ranged from 0.53 to 32%, with a geometric mean value of 7.8% [*4*].
- Soil and debris from each of the sites was collected in bags, drums, and boxes. Each of these containers also was incinerated.

TREATMENT SYSTEM DESCRIPTION

Primary Treatment Technology

IT Corporation's Hybrid Thermal Treatment System® (Incineration system) including:

- Solid waste feed system
- Countercurrent, controlled air rotary kiln with oxygen-enhanced burner manufactured by Kennedy Van Saun
- Secondary combustion chamber

Supplemental Treatment Technology

Pretreatment (solids):

- Lime addition
- Screening and shredding

Post-Treatment (air):

- Gas Clean System manufactured by the John Zink Company including:
  - — Water quench tower
  - — Two-stage scrubber
  - — Vane separator
- Environmentally Safe Temporary Emergency Relief System® (ESTER®)

Post-Treatment (water):

- On-site wastewater treatment system.

TREATMENT SYSTEM DESCRIPTION (CONT.)

System Description and Operation

- The contaminated soil had a relatively high moisture content. To prevent the buildup of excessive pressure in the kiln, the soil was pre-treated to remove moisture. Lime was added to the soil or, if time permitted, the soil was sun-dried.

- Other feed material was prepared for incineration using several pieces of equipment. Material preparation took place in the Feedstock Handling Building, which was maintained at a slight negative pressure to prevent fugitive emissions. An initial screening device allowed six inch or smaller materials to fall into a crushing circuit. Material greater than six inches was broken up with mobile equipment. The material was then stacked radially within the building and a magnetic separator removed metal items which could damage processing and conveying equipment. The material was then fed into a shredder, which crushed the material to a two inch or smaller size. The material was then blended to achieve the desired feed consistency [4]. Once the material was prepared, it was fed to the kiln by an enclosed conveyor.

- The kiln had a length of 75 feet, an outside diameter of 13 feet, 7.5 inches, and an installed slope of 0.25 inches per foot. The kiln was lined with 9 inches of high-temperature, acid resistant, insulating refractory and was designed such that the optimal throughput of contaminated soil was approximately 38 tons per hour. The kiln rotated at a maximum rate of 60 revolutions per hour with a corresponding solids residence time of 1 hour.

- The kiln employed an oxygen-enhanced burner which had a firing capacity of 40 million BTU/hr and operated at approximately 1,250°F. The oxygen-enhanced burner increased incinerator productivity by increasing heat transfer and throughput rate.

- Residual ash from the kiln was transferred to a treated materials cooler and was water quenched until it reached 200°F. The ash was then sampled and analyzed to ensure that it met treatment criteria. If the ash met the criteria, it was landfilled on site; if not, it was re-incinerated.

- Flue gases from the kiln were routed to the SCC to ensure complete combustion of volatilized contaminants. The SCC was downfired, with an outside diameter of 12 feet, and a height of 38 feet. The SCC operated at approximately 1,750°F. The flue gas residence time in the SCC was approximately 2 seconds for a gas flow rate of 87,000 actual cubic feet per minute (acfm).

- The exhaust gas from the SCC was then routed to the system's GCS. Off-gas entering the GCS first passed through a quench contactor where gas was cooled by the evaporation of water. From the quench contactor the off-gas was channeled to the gas conditioner. The gas conditioner contained wetted packing material, to provide a surface area for the collection of particulate matter. Following the gas conditioner, the off-gas passed through two Hydro-sonic® scrubbers where high-energy water sprays created small droplets to capture particulate matter. The last stage of the GCS was a vane separator, which contained multiple flat surfaces onto which collected particulate matter that was entrained in water droplets [4].

- Water used in the GCS was recycled in a sump below the unit. The blowdown from this sump was either reused to quench the ash from the incinerator or treated in an on-site waste water treatment facility. Particulate matter removed in the treatment process was dried, and subsequently sampled and analyzed to determine whether it could be disposed of on the site.

TREATMENT SYSTEM DESCRIPTION (CONT.)

System Description and Operation (Cont.)

- The GCS was rated for a design particulate loading of 0.01 grains per dry standard cubic foot, corresponding to a particulate emission rate of 1 pound per hour [*5*]. The design operating conditions for GCS flow rate and exit temperature were 12,000 dry cubic feet per minute (dcfm) and 200°F, respectively.
- Combustion gases were drawn through the kiln system and GCS by an induced-draft fan and were exhausted through a 100-foot stack. Typical stack gas flow was 37,000 acfm.
- The incinerator was also equipped with an emergency backup system. The Environmentally Safe Temporary Emergency Relief System® (ESTER®), provided for combustion of contaminants in the kiln in the event of a forced shutdown of the incinerator. During such an event, the rotary kiln gases were diverted to the ESTER®, which contained a propane-fired oxidation system to thermally treat the off-gases before release to the atmosphere. The ESTER® stack was designed to reach a temperature of 1800°F.

TREATMENT SYSTEM PERFORMANCE

Cleanup Goals/Standards

- The ROD site performance requirements and the MDNR established a DRE of 99.9999% for TCDD.
- The ROD rated that soils with TCDD concentration exceeding 1 µg/kg at the surface or exceeding 10 µg/kg at a depth of 1 foot are of concern for the protection of human health in residential settings. However, the ROD also stated higher TCDD concentrations would be acceptable in commercial and industrial settings and concluded that a 20 µg/kg TCDD concentration cleanup level would provide adequate protection of public health when considering the future expected land use at the site [*2*].
- Cleanup standards required incineration of soil with a TCDD concentration exceeding 20 µg/kg. A clean soil cover of at least 1 foot was required for soil with TCDD concentrations from 1 - 20 µg/kg.
- A risk assessment concerning the operation of the incinerator estimated that the excess lifetime cancer risk level was below 1×10^{-6} for all residents in the immediate vicinity of the site.

TREATMENT SYSTEM PERFORMANCE (CONT.)

Treatment Performance and Compliance

- A trial burn conducted at Times Beach was designed to operate the incineration system at conditions that would reflect worst case destruction and removal of all constituents of concern. Hexachloroethane and 1,2,4-trichlorobenzene were selected as the principal organic hazardous constituents (POHC). The reported DREs for each POHC are included in Table 2.
- AWFCO limits and the frequency of occurrence of AWFCOs during the operation of the incinerator are shown in Table 3.
- The incinerator at Times Beach operated within the operating limits established during the trial burn signifying that all cleanup requirements established in the ROD were met. Values for trial burn and actual operating parameters are shown in Table 4.
- The residual ash was sampled and analyzed in accordance with standards set in the CERCLA Exclusion for Times Beach Thermal Treatment Residues which required that the ash meet Toxicity Characteristic Leaching Procedure (TCLP) landfill standards for metals. The results of this analysis are presented in Table 5.
- MDNR provided oversight at Times Beach to ensure proper facility operation. Additionally, St. Louis county officials inspected operations and tracked air-monitoring to ensure that the emissions were in compliance with the county's air pollution permit.

Table 2. Average Destruction and Removal Efficiencies from Trial Burn [7]

Contaminant	Average Contaminant Feed Rate in Soil (lbs/hr)	Average Contaminant Rate in Stack Gas Emissions (lbs/hr)	Average Contaminant Concentration in Residual (µg/kg)	DRE (%)
Hexachloroethane	14.7	1.87×10^{-6}	<360	99.999987
1,2,4-Trichlorobenzene	14.9	2.91×10^{-6}	<360	99.999981

Table 3. Automatic Waste Feed Cutoffs [3]

Parameter	Cutoff Limit	Frequency[1]
Maximum contaminated soil feed rate[2]	41.7 tph	Rarely
Maximum CO concentration in stack gas (@ 7% oxygen)[2]	100 ppmv	Never
Minimum kiln exit gas temperature[3]	1,117°F	Rarely
Minimum SCC exit gas temperature	1,714°F	Rarely
Maximum stack gas flow rate[2]	38,260 acfm	Once
Minimum GCS differential pressure[3]	24.2 inches H_2O	Never
Maximum quench exit gas temperature	250°F	Rarely
Maximum kiln pressure	-0.08 inches H_2O	Daily[4]
Maximum quench recirculation rate	400 gpm	Rarely
Minimum quench recirculation pump power	0 kW	Rarely

TREATMENT SYSTEM PERFORMANCE (CONT.)

Table 3. Automatic Waste Feed Cutoffs [3]

Parameter	Cutoff Limit	Frequency[1]
Minimum Hydro-1 recirculation rate	307 gpm	Rarely
Minimum Hydro-2 recirculation rate	215 gpm	Rarely
Minimum scrubbing liquid pH in Hydro-2 sump	5.2 s.u.	Rarely
Maximum ID for vibration	0.45 in/sec	Rarely
Maximum ID for current	720 A	Rarely
Minimum WESP secondary voltage	17.4 kV	Rarely
Minimum gas O_2 concentration	3.5% by volume	Never

[1]AWFC logs were not maintained. These descriptions represent operator estimates.
[2]1-hour rolling average
[3]10-minute rolling average
[4]High moisture content in the soil has caused overpressurization of the kiln. This caused 2 to 12 automatic waste feed cutoffs per day and was the primary cause of AWFCO

s.u. = standard PH units
tph = tons per hour
acfm = actual cubic feet per minute
gpm = gallons per minute
A = amps
kV = kilovolts

Table 4. Operating Parameters [7,8]

Parameter	Actual Value[1]	Trial Burn Value
Contaminated Soil Feed Rate	31 tph	41.7 tph
Fuel Fired Feed Rate	40 million BTU/hr	40 million BTU/hr
Emission Rate		
Particulate	NA	0.94 lb/hr
HCl	Not Monitored	0.014 lb/hr
Cl_2	Not Monitored	0.0023 lb/hr
CO_2	9% by dry volume	11.7% by dry volume
O_2	7-8% by volume	6.7% by volume
Lead	Not Monitored	0.0082 lb/hr
No_x	Not Monitored	15.7 lb/hr
Operating Conditions		
CO Concentration in Stack Gas	Trace	Trace
Kiln Exit Gas Temperature	1,250°F	1,117°F
SCC Exit Temperature	1,750°F	1,714°F
Stack Gas Flow Rate	37,000 acfm	38,300 acfm
GCS Differential Pressure	25 inches H_2O	24.2 inches H_2O
Quench Exit Gas Temperature	200°F	250°F

[1]Actual Value: anticipated parameters for daily operations as projected in the Trial Burn Report.
tph - tons per hour
acfm - actual cubic feet per minute

TREATMENT SYSTEM PERFORMANCE (CONT.)

Table 5. TCLP Comparison for Residual Ash

Constituent	Regulatory Concentration (mg/L)[a]	Average TCLP Concentration (mg/L)
Arsenic	5.0	0.042
Barium	100.0	0.278
Cadmium	1.0	0.072
Chromium	5.0	0.008
Lead	5.0	0.233
Mercury	0.2	< 0.0008
Selenium	1.0	0.041
Silver	5.0	< 0.004

Note: Only contaminants that were analyzed for are included in this table.
[a]Excerpted from 40 CFR § 261.24 Table 1.

Performance Data Completeness

- Data are available for concentrations of TCDD in the soil before treatment.
- Data are also available for concentration of TCDD in incinerator residuals. These data were collected before residuals were disposed of on the site.

Performance Data Quality

- The QA/QC program used during the remedial action met EPA and MDNR requirements. All monitoring and sampling and analysis was performed using EPA-approved methods.

TREATMENT SYSTEM COST

Procurement Process

- The RP contracted with Foster Wheeler Environmental Corporation to manage the Times Beach site. IT Corporation was contracted by Foster Wheeler to operate the incinerator at the site.

Cost Data

- The cost for operation of the incinerator at Times Beach was $110,000,000. A total of 265,000 tons of soil and debris were incinerated. This corresponds to a total unit cost for incineration of $800 per ton. A detailed breakdown of these costs was not available.

OBSERVATIONS AND LESSONS LEARNED

Observations and Lessons Learned

- Site personnel experienced problems with the power supply to the incinerator. One incident involved an unexpected storm which interrupted power supply. Strong wind gusts from the storm blew out the pilot lights on the ESTER® system. Therefore, when the power was interrupted and the kiln shut down, kiln gases routed to the ESTER® were released directly to the ambient atmosphere. Emission levels used in this analysis could only be estimated because the air-monitoring equipment was on the same electrical circuit as the incinerator and did not operate. To prevent future weather-related occurrences, the operator decided to work closely with the local weather service to receive accurate weather forecast updates. Subsequently, the waste feed was ceased during severe weather.
- High moisture content in the waste feed caused overpressurization in the kiln resulting in 2 to 12 automatic waste feed cutoffs per day. Site personnel noted that excavating the soil when it was dry would have been the best way to avoid this problem. However, at the time of remediation, soil was either being (1) excavated immediately prior to incineration due to time constraints, which did not always allow the soil to be excavated when it was dry or (2) was stored in large bags from other sites. In response to this problem, personnel at the Times Beach site added lime to the soil, or, if time permitted, let it sun dry to reduce moisture content before feeding the soil to the incineration [11].
- An estimated 1,900 tons of incinerator ash required re-incineration because it did not meet requirements. Following re-incineration, it met the requirements and was able to be backfilled on site.

Public Involvement

- The concern most frequently expressed by local residents was the possibility that the Times Beach incinerator would eventually be used to incinerate dioxin-contaminated material from other states. EPA and MDNR assured the public that the Times Beach incinerator would cease operation once the cleanup from the 27 sites in Missouri was completed [11].
- Before remediation began at the site, local residents expressed concern about the potential for excessive noise from the incinerator. This never became a problem because the operations took place within enclosed buildings. This also served to prevent fugitive emissions during materials handling.

REFERENCES

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2. Superfund Record of Decision, Times Beach, Times Beach, Missouri, September 9, 1988.

3. Letter to Mr. Gary J. Pendergrass, P.E., Project Coordinator for the Settling Defendants, from Mr. David A. Shorr, Director of the Missouri Department of Natural Resources, Information on Modified Hazardous Waste Management Facility Permit for Times Beach, March 15, 1996.

4. Engineering Description and Trial Burn Plan, Times Beach Thermal Treatment Unit, IT Pollution Control Engineering, April 1994.

5. Final Times Beach Site Multimedia Risk Assessment Vol. I, U.S. Environmental Protection Agency, March 28, 1995.

6. Letter to Mr. David Shorr, Director of the Missouri Department of Natural Resources, from Mr. Fred Striley, Dioxin Incineration Response Group, Information on permit application for the Times Beach incinerator, June 18, 1995.

7. Trial Burn Report for the Times Beach Remediation Project, IT Corporation, January 1996.

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11. Personal Communication, Mr. James Silver, March 27, 1997.

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