On-Site Incineration at the
Sikes Disposal Pits Superfund Site
Crosby, Texas

Incineration at the Sikes Disposal Pits Superfund Site
Crosby, Texas

Site Name:
Sikes Disposal Pits Superfund Site

Location:
Crosby, Texas

Contaminants:
Organic and Phenolic Compounds
- Naphthalene, chlorobenzene, creosote, toluene, xylene, dichloroethane, and vinyl chloride
- Maximum concentrations in mg/kg - naphthalene (58), chlorobenzene (2.3), toluene (5), dichloroethane (20), and vinyl chloride (1).

Period of Operation:
February 1992 to June 1994

Cleanup Type:
Remedial action

Vendor:
Mike Gust
International Technology Corporation
2790 Mosside Boulevard
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(800) 444-9586

Technology:
On-Site Incineration
- Soil and debris pretreated with shredding and mixing with lime
- Incineration system consisting of rotary kiln and two secondary combustion chambers (SCCs)
- Enclosed conveyor transported contaminated soil and debris to the unit
- Soil residence time of 45 minutes, kiln temperature of 1,300°F, SCC temperature of 1,800°F
- Treated soil and debris (incinerator ash) discharged into rotary mixer, where it is sprayed with water

Cleanup Authority:
CERCLA and State: Texas
- ROD Date: 9/18/86
- State-lead

SIC Code:
Not Applicable

Point of Contact:
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Waste Source:
Disposal Pits - drummed and bulk wastes

Purpose/Significance of Application:
Third largest Remedial Action Contract ever awarded to incinerate nearly 1/2 million tons of contaminated soil and debris

Type/Quantity of Media Treated:
Soil and Debris
- 496,000 tons of soil and debris
- Moisture Content: soil - 10 - 12%
- Soil Density (*in situ*): 1.58 - 1.72 g/cm^3

Regulatory Requirements/Cleanup Goals:
- Destruction and Removal Efficiency (DRE) of 99.99% for principal organic constituents of concern as required by Resource Conservation and Recovery Act (RCRA) incinerator regulations, 40 CFR part 264, subpart O

Results:
- Emissions and trial burn data indicated that all DRE and emissions standards were met
- Analytical data of residuals indicated that cleanup goals were met

Incineration at the Sikes Disposal Pits Superfund Site
Crosby, Texas

(Continued)

Description:
Between 1961 and 1967, the Sikes Disposal Pits Superfund Site was the location of the unpermitted disposal of drummed and bulk wastes into unlined sand pits. A remedial investigation determined that soil at the site was contaminated with VOCs and PAHs. A Record of Decision (ROD), signed in September 1986, specified on-site incineration as the remedial technology for the soil and debris. Site cleanup goals and DRE standards were specified for the organic constituents of concern.

Remedial Activities began in October 1990 when IT/Davy began clearing the site. On-site incineration using the IT Corporation Hybrid Thermal Treatment System® began in February 1992 and concluded in June 1994. Following demobilization and site cleanup, remedial activities ceased in December 1994. The treatment system consisted of a rotary kiln and two SCCs. An enclosed conveyor moved the soil and debris to the kiln for treatment. Ash from the incinerator was discharged to a rotary mixer where it was quenched with water. Incineration achieved the soil cleanup goals specified in the ROD.

The total cost of the Remedial Action was approximately $115,000,000. Capital costs accounted for approximately $20,000,000. Operation and maintenance costs accounted for approximately $95,000,000.

EXECUTIVE SUMMARY

This report presents cost and performance data for the application of on-site incineration at the Sikes Disposal Pits Superfund site in Crosby, Texas. A rotary kiln incinerator was operated from February 1992 through June 1994 as part of a remedial action. Contaminants of concern at the site were organic and phenolic compounds including naphthalene, chlorobenzene, creosote, toluene, xylene, halides, dichloroethane, and vinyl chloride.

The Sikes Disposal Pits site was used for the disposal of drums and bulk wastes from 1961 through 1967. During this period, an estimated 1,500 fifty-five gallon drums and an undetermined amount of bulk waste was disposed of at the site. During the remedial investigation, soil concentrations were measured as high as 58 mg/kg for naphthalene, 2.3 mg/kg for chlorobenzene, 5 mg/kg for toluene, 20 mg/kg for dichloroethane, and 1 mg/kg for vinyl chloride.

In June 1982, EPA signed a cooperative agreement with the Texas Water Commission (TWC), currently the Texas Natural Resource Conservation Commission (TNRCC), to oversee response actions at the site. A Record of Decision (ROD) signed in 1986 established a destruction and removal efficiency (DRE) of 99.99% for organic contaminants.

EPA and TWC conducted remedial activities including the operation of a rotary kiln incinerator to dispose of the contaminated soil. The incineration system used at Sikes Disposal Pits was comprised of a solid waste feed system; a countercurrent, controlled-air, rotary kiln; two secondary combustion chambers (SCCs); two wet gas cleaning systems (GCSs); and a treated materials handling system.

In order to prepare the feedstock, soil excavated at the site was mixed with lime if its moisture content was above a prescribed level, and drums were shredded to reduce their size 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 quenched with water while off-gas was drawn into one of the two parallel SCCs. The SCCs were down-fired steel shells that provided further combustion of contaminants in the off-gases. The incinerator and both SCC's were fueled by natural gas.

Treated gas was then drawn into the GCS, which consisted of a quench section for cooling, and a venturi scrubber and a two-stage Hydro-Sonic® scrubber for removal of particulate matter. The GCS cooled the gas from the SCC and controlled particulate and acid gas emissions. Ash and dust collected from the incinerator and GCS were sampled and analyzed to determine whether they were in compliance with on-site land disposal requirements, at which time they were landfilled on site.

During the 28 months of operation, the incinerator processed approximately 496,000 tons of contaminated soil and debris and the on-site water treatment system treated 350 million gallons of contaminated groundwater and stormwater. Treatment performance and emissions data collected during incinerator operation indicated that all performance standards and emissions requirements were achieved.

The actual total cost for remediation using the incineration system was approximately $115,000,000. This amount consisted of approximately $20,000,000 in capital costs and $95,000,000 in operating costs.

SITE INFORMATION

Identifying Information

Sikes Disposal Pits Superfund Site
Crosby, Texas

CERCLIS # TXD980513956

ROD Date: September 18, 1986

Treatment Application

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

Period of operation: February 1992 - June 1994

Quantity of material treated during application: 496,000 tons of soil and debris

Background

Historical Activity that Generated Contamination at the Site: Waste disposal

Corresponding SIC Code: Not applicable

Waste Management Practice That Contributed to Contamination: Disposal of drummed and bulk waste in unlined sand pits

Site History:

- The site was used in the 1950s as a source of sand for local construction projects. The site subsequently was used for disposal of drums and bulk wastes from 1961 until 1967.
- The Sikes Disposal Pits is an 185-acre site bordered on the west by the San Jacinto River and on the north by the Jackson Bayou. The majority of the site is within the 10-year flood plain and the entire site is within the 100-year flood plain.
- During this period, an estimated 1,500 fifty-five-gallon drums were disposed of in unlined sand pits. An undetermined amount of bulk waste was dumped or pumped into low-lying areas and sand pits.
- The contents of the drums were not analyzed. By the time remedial activities began, the contents of the drums had solidified into a substance with a consistency similar to tar. The contents had been exposed to the air for many years, allowing the volatile compounds to evaporate, leaving a very low concentration of volatile organic compounds within the drums.
- Soil at the site was contaminated with organic and phenolic compounds, including naphthalene, chlorobenzene, creosote, toluene, xylene, halides, dichloroethane, and vinyl chloride.
- A site investigation was conducted by Region VI of EPA and TWC in 1981. In June 1982, EPA and TWC signed a cooperative agreement to oversee response actions at the site. A Remedial Investigation and Feasibility Study (RI/FS) was conducted from May 1983 until June 1986.
- Based on the RI/FS, a ROD was signed in September 1986, specifying a remedy which included on-site incineration to reduce the concentration of contaminants in soil and debris at the site.

SITE INFORMATION (CONT.)

Background (Cont.)

- Construction management and oversight services for the remedial action activities began in September 1989. In April 1990 TWC awarded the remedial action contract to the joint venture of International Technology Corporation and Davy McKee Corporation (IT/Davy).

- Remedial activities began in October 1990 when IT/Davy began clearing the site. Flood protection at the site was required due to its location in the flood plain. IT/Davy constructed an earthen embankment structure to elevate the incineration facility above the 100-year flood plain and constructed a dike around the Main Waste Pit area. As required in the Remedial Action Contract, the structures were a minimum of two feet above the 100-year floodplain.

- A shallow aquifer is located two to ten feet below the pre-excavation ground surface. Sampling and subsequent analysis showed that the aquifer was contaminated by leaching of contaminants from organic sludge in waste pits.

- A second aquifer located 65 feet below the shallow aquifer and separated from the shallow aquifer by plastic clay showed concentrations of contaminants just above detection limits.

- A third aquifer, the Chicot aquifer, is located 140 feet below the second aquifer and serves as a primary drinking water source for the city of Houston. The second aquifer and the Chicot aquifer are separated by clay. As a result, it was assumed that the Chicot aquifer was not affected by the contamination at the site [2].

- Pre-trial burns were conducted at the site in February and March 1992, followed by a trial burn in April 1992. While awaiting approval of trial burn results the incinerator operated under interim conditions (at reduced throughput) from April through August 1992. Upon approval of the trial burn conditions in August 1992, the incinerator began operating at full production rate.

- IT/Davy processed approximately 496,000 tons of soil and debris between February 1992 and June 1994. Following the completion of the incineration of contaminated soil and debris, IT/Davy began demobilization and the last stage of the cleanup, the planting of native grasses. By December 1994, all of the soil cleanup goals specified in the ROD had been met and all soil-related remedial activities ceased. In April 1995 the final inspection of the worksite took place.

Regulatory Context:

- In 1982, EPA and TWC entered into a cooperative agreement, which included remediation activities at the site in Crosby, Texas.

- In 1983, the Sikes Disposal Pits site was placed on the National Priorities List (NPL).

- As a result of the cooperative agreement, EPA and TWC identified site cleanup requirements described in a ROD signed on September 18, 1986 [1].

- 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) 40 CFR part 300 [1].

- The DREs were set according to Resource Conservation and Recovery Act (RCRA) incinerator regulations in 40 CFR part 264, subpart O.

Remedy Selection: On-site incineration was selected as the remedy for contaminated soil and debris at the Sikes Disposal Pits Superfund site based on treatability study results and long-term economic, public health and welfare, and environmental considerations.

SITE INFORMATION (CONT.)

Timeline

Table 1. Timeline [2]

Date	Activity
1961 -1967	Wastes were disposed of at the Sikes Disposal Pits site
1981	EPA and TWC conducted site investigations
1982	EPA and TWC signed cooperative agreement to oversee Sikes Disposal Pits remediation
1983	Sikes Disposal Pits site placed on NPL
May 1983 - June 1986	Remedial Investigation/Feasibility Study
September 1986	Record of Decision signed specifying on-site incineration
September 1987 - December 1988	Remedial design
October 1990	IT/Davy began clearing site
February - March 1992	Pre-Trial Burns conducted
April 1992	Trial Burn conducted
April - August 1992	Interim operation of incinerator
August 1992 - June 1994	Full operation of incinerator
June 1994	Ash backfill completed
December 1994	Completion of soil-related remedial activities
April 1995	Final inspection of worksite

Site Logistics/Contacts

Site Management: State-lead

Oversight: EPA

Remedial Project Manager:
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MATRIX DESCRIPTION

Matrix Identification

Type of Matrix Processed Through the Treatment System:

- Soil from the unlined sand pits.
- Drums which were disposed of on site.

Contaminant Characterization

Primary Contaminant Groups: Organic and phenolic compounds

- The contaminants of greatest concern were: naphthalene, chlorobenzene, creosote, toluene, xylene, dichloroethane, and vinyl chloride.
- The maximum concentrations detected in mg/kg were naphthalene (58), chlorobenzene (2.3), toluene (5), dichloroethane (20), and vinyl chloride (1).

Matrix Characteristics Affecting Treatment Costs or Performance

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

Table 2. Matrix Characteristics [3]

Parameter	Value
Moisture Content	10 - 12%
Soil Density (*in situ*)	1.58 - 1.72 g/cm^3

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 manufactured by Kennedy Van Saun
- Two parallel secondary combustion chambers.

Supplemental Treatment Technology

Pretreatment (solids):

- Lime addition
- Shredder.

Post-Treatment (air):

- Gas cleaning 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 and drums were excavated using track excavators and loaded onto 25-ton haul trucks for transport. Drums were taken to the solid waste feed system in the Feed Preparation Building and soil was taken to a staging pad for blending with other materials.

- Blending at the staging pad was accomplished through the use of bulldozers and discs [2]. The Feed Preparation Building was maintained at a slight negative pressure to control volatile organic compound (VOC) emissions. This building housed a shredder to prepare material for treatment, and had the capacity to store up to a five-day supply of material for the incinerator. The prepared material was fed to the incinerator by an enclosed conveyer.

- Some of the excavated soil had a high clay content, resulting in difficulties homogenizing the incinerator feed stock. To better prepare the feed stock, lime was added to the soil if it was wet. Drums were prepared by placing them in the shredder to reduce their size to acceptable standards for the incinerator.

- The kiln was 75 feet in length, had an outside diameter of 14 feet, and was lined with high-temperature refractory. The average throughput of waste feed was approximately 29 tons per hour (tph) with a corresponding solids residence time of 45 minutes. The kiln was rated at 120 million BTU/hr and operated at approximately 1,300°F. A negative pressure was maintained within the kiln in order to prevent fugitive emissions.

- Residual ash from the kiln was transferred to the treated material quench facility where it was water cooled in a rotary mixer to a temperature of 180°F. The ash was then placed in storage bins to await testing to ensure that it met Toxicity Characteristic Leaching Procedure (TCLP) criteria. Following sampling, analysis, and necessary approval, the quenched ash was landfilled on site. All of the ash met site-specific land disposal requirements.

- Flue gases from the kiln were routed to one of the two vertically downfired SCCs for further combustion of volatilized contaminants. The incineration system was configured with an SCC and its respective GCS in parallel with another SCC and GCS. The SCCs operated at approximately 1,800°F. The flue gas residence time in the SCCs was a minimum of 2 seconds.

- The exhaust gas from the SCCs was channeled to the GCS, where it was first cooled to a temperature of 220°F in the GCS's water quench section. A venturi scrubber and a two-stage Hydro-Sonic® scrubber were then used to control particulate and acid gas emissions.

- Water used in the GCS was collected in sumps below the unit. This water, along with water from the ash quench, was treated in an on-site waste water treatment system.

- Two systems that treated the water from the GCSs and the ash quench contained hydroclones and clarifiers to remove suspended solids from the process water and a belt filter press to dry the solid materials for handling [2]. The treatment processes were closed systems with the water being discharged into on-site holding ponds. A third water treatment system was used to treat contaminated groundwater and stormwater collected from the site.

TREATMENT SYSTEM DESCRIPTION (CONT.)

System Description and Operation (Cont.)

- Combustion gases were drawn through the kiln system and GCS by induced draft fans and were exhausted through two 85-foot fiberglass stacks. Typical flue gas velocity was 26,500 actual cubic feet per minute and the typical stack exit temperature was 220°F.
- The incinerator also was 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 was equipped with a 60 million BTU Burner to thermally treat the gases before release to the atmosphere.

Table 3. Summary of Operating Parameters

Parameter	Value
Residence Time	45 minutes
System Throughput	29 tph
Kiln Exit Gas Temperature	1,300°F

TREATMENT SYSTEM PERFORMANCE

Cleanup Goals/Standards

- The cleanup goals and standards were specified in the ROD. The DRE was set based on RCRA incinerator regulations in 40 CFR part 264, subpart O.
- A DRE of 99.99% was required for each contaminant of concern.
- Cleanup standards required the excavation and treatment of soil and debris with volatile organic aromatic concentration greater than 10 mg/kg.
- Ash residuals had to pass the Toxicity Characteristic Leaching Procedure (TCLP) before on-site disposal.

Treatment Performance and Compliance

- A trial burn conducted at Sikes Disposal Pits was designed to operate the incineration system at conditions that would reflect worst case destruction and removal of all constituents of concern.
- Naphthalene was selected as a principal organic hazardous constituent (POHC) because it was a semivolatile organic compound present at high concentrations at the site and because it has a high Thermal Destructibility Ranking. Chlorobenzene also was selected because it is a volatile organic compound, was present in abundance at the site, has a high Thermal Destructibility Ranking, and is a source of chlorine residuals [2].

TREATMENT SYSTEM PERFORMANCE (CONT.)

Treatment Performance and Compliance (Cont.)

- The incinerator at Sikes Disposal Pits operated within the operating limits established during the trial burn. The AWFCOs limits used during the incineration action and their frequency of occurrence are shown in Table 4. Trial burn and actual operating parameters are shown in Table 5.
- The residual ash was sampled and analyzed to see if it was in compliance with the Remedial Action Contract's on-site land disposal requirements. The residuals were tested had to pass the TCLP before land disposal. These data are presented in Table 6.

Table 4. Automatic Waste Feed Cutoffs [2]

Parameter	Cutoff Limit	Frequency
Maximum contaminated waste feed rate[1]	45.76 tph	244
Maximum kiln pressure[2]	0.0 inches w.c.	975
Minimum kiln exit gas temperature[3]	1,058°F	36
Maximum total SCC water gun flow rate[3]	17.5 gpm	0
Minimum SCC exit gas temperature[3]	1,688°F	40
Maximum quench outlet gas temperature[3]	191°F	120
Minimum gas conditioner recirculation flow rate[4]	28 gpm	8
Minimum GCS-1 recirculation flow rate[4]	251.6 gpm	12
Minimum GCS-2 recirculation flow rate[4]	183 gpm	9
Minimum GCS-2 sump pH[4]	6.9	148
Minimum pressure differential across GCS-1 and 2[3]	32.2 inches w.c.	114
Minimum stack gas O_2 concentration[3]	3%	148
Maximum CO concentration in stack gas (@ 7% oxygen)[3]	500 ppm	1
Maximum stack gas corrected THC concentration (@ 7% oxygen)[5]	20 ppm	5
Maximum stack gas flow rate[3]	47,550 acfm	5

[1]15-minute rolling average
[2]30-second delay
[3]Instantaneous
[4]5-minute delay
[5]1-hour rolling average
tph = tons per hour
gpm = gallons per minute
ppm = parts per million
acfm = actual cubic feet per minute
w.c. = water column

TREATMENT SYSTEM PERFORMANCE (CONT.)

Table 5. Operating Parameters [4]

Parameter	Actual Value[a]	Trial Burn Value
Contaminated Soil Feed Rate	29 tph	45.76 tph
Fuel Fired Feed Rate	120 million BTU/hr	120 million BTU/hr
Emission Rate[c]		
Particulate	1.1 µg/m^3	16,704 µg/m^3
HCl	Not Available	<0.027 lb/hr
SO_2[c]	0.8 µg/m^3	268.8 µg/m^3
Lead[d]	0.03 µg/m^3	NA
NO_x	1.5 µg/m^3	NA
Operating Conditions		
Kiln pressure	-0.75 inches w.c.	NA
CO concentration in gas	14.4 µg/m^3	1.0
Kiln exit gas temperature	1,300°F	1,058°F
SCC exit temperature	1,800°F	1,688°F
Stack gas flow rate	42,000 acfm	47.550 acfm
Minimum GCS pressure drop	34 inches wc	32.2 inches wc
Quench exit gas temperature	180°F	NA

w.c. = Water column.
[a]Actual value: average parameters for daily operations as reported in the Remedial Action Report.
[b]Corrected to 7% O_2.
[c]Annual value.
[d]Quarterly value.

Table 6. TCLP Comparison for Residual Ash [2]

Constituent	Regulatory Concentration (mg/L)[a]	Average TCLP Concentration (mg/L)
Arsenic	5.0	< 0.5
Barium	100.0	< 10.0
Cadmium	1.0	< 0.1
Chromium	5.0	< 0.5
Lead	5.0	< 0.5
Mercury	0.2	< 0.02
Selenium	1.0	< 0.1
Silver	5.0	< 0.5

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 contaminants in the soil before treatment.
- Data are also available for TCLP analysis for contaminants in the incinerator residue. These data were collected periodically throughout operation of the incinerator prior to landfilling.

TREATMENT SYSTEM PERFORMANCE (CONT.)

Performance Data Quality

- According to site personnel, the QA/QC program used throughout the remedial action met EPA and TWC requirements established in the ROD. All monitoring was performed using EPA-approved methods.

TREATMENT SYSTEM COST

Procurement Process

- TWC contracted with Lockwood, Andrews, & Newnam, Inc. (LAN) to manage the Sikes Disposal Pits site. IT/Davy was contracted to provide and operate the incinerator at the site.

Cost Data

- The estimated treatment cost of $115,000,000 was reported by LAN and IT/Davy in terms of capital costs and operation and maintenance costs. The estimated capital costs for the incineration system were $20,051,000 and estimated operation and maintenance costs totaled $95,027,000 [5]. The estimated total cost for thermal treatment was $81,000,000. A total of 496,000 tons of soil and debris were incinerated. This corresponds to a total unit cost for incineration of $230 per ton, and a unit cost of $160 per ton for thermal treatment.

Capital Costs [2,5]

WBS Number		Description	Cost
331	01	Mobilization and preparatory work	$11,811,000
331	02	Monitoring, sampling, testing, and analysis	$139,000
331	03	Sitework	$3,986,000
331	05	Surface water collection and control	$4,020,000
331	22	General requirements	$95,000
		Total Capital Costs	*$20,051,000*

Operation and Maintenance Costs [2,5]

WBS Number		Description	Cost
342	02	Monitoring, sampling, testing, and analysis	$1,894,000
342	03	Sitework	$2,335,000
342	14	Thermal Treatment (Incineration) which includes: • Equipment • Labor • Direct operating costs • Overhead	$81,000,000
342	18	Disposal	$3,044,000
342	22	General requirements	$6,754,000
		Total Operation and Maintenance Costs	*$95,027,000*

TREATMENT SYSTEM COST (CONT.)

Cost Data Quality

- Actual capital and operations and maintenance cost data are available from the treatment vendor and EPA Region 6 for this application.

OBSERVATIONS AND LESSONS LEARNED

Cost Observations and Lessons Learned

- Actual costs for the project were approximately 26% more than the projected costs because the volume of contaminated soil that required treatment was 45% greater than anticipated.
- Change orders amounted to 25% of the original contract cost.
- The added cost of building and installing an additional SCC train was offset by the fact that the extra train increased the throughput rate of incinerator, which decreased the amount of time that the unit would have had to operate. IT/Davy anticipated that it would cost less money to build an extra train and operate for a shorter amount of time than to operate with only one train [6].

Other Observations and Lessons Learned

- Operation at the site was completed approximately 18 months before the deadline specified in the remedial action contract even though 496,000 tons of material was incinerated instead of the 342,000 tons originally estimated [4]. Because the incinerator used by IT/DAVY was over three times larger than required and the average throughput rate of 29 tons per hour was almost two and a half times greater than the minimum throughput rate of 12 tons per hour required in the contract, the remediation was completed ahead of schedule.
- The incinerator provided by IT/Davy was larger than required because it was anticipated that the incinerator would be used at two other sites following Sikes Disposal Pits. Building the incinerator larger, therefore, cut down on overhead costs when compared to building three separate incinerators. The incinerator used at Sikes Disposal Pits, along with one SCC train, was transported to the Times Beach Superfund Site upon the completion of the project [6].
- The limiting factor for the throughput rate of the incinerator was the size of the SCC train and its capacity to channel kiln off-gas. The SCC train size was constrained by the fact that it had to be transported to the site. One SCC train would not have allowed the incinerator to operate at its intended capacity. Therefore, the decision was made by IT/Davy to install a second SCC train in parallel with the first, giving a 30% increase in throughput rate. The two trains were designed to operate simultaneously; however, one train could be shutdown for routine maintenance while the incinerator still functioned with one operating train [6].
- Drum handling was an important issue on site. Separate protocols were developed for handling both intact and ruptured drums. When excavation was completed, however, it was discovered that only one intact drum existed. Few volatile organic compounds remained in the ruptured drums because they had previously leaked into the soil or into the

OBSERVATIONS AND LESSONS LEARNED (CONT.)

air. Site management felt that resources had been spent developing a protocol for conditions at the site which did not exist, and a more thorough investigation might have avoided this situation.

- During operations, 86 ESTER® events occurred at the site. Each event was typically 2 to 3 minutes in length, beginning with a shutdown of the induced draft fans and the opening of the vent from the incinerator to the ESTER® stack. A dark particulate plume was visible around the ESTER® stack during the event, but no significant changes were measured by monitors in ambient air quality [2].

Following the events there was approximately a 45 minute delay which occurred to get the system back on-line. The cause of the events was usually a problem with instrumentation and not a problem with incinerator operation [3].

- Overpressurization of the kiln caused frequent AWFCOs. The primary cause of the overpressure in the kiln was related to slag build-up in the SCCs. As the slag built up, it would eventually fall to the bottom of the SCC chamber, which contained a water well. The slag falling into the water generated steam, which would then back-up into the kiln creating overpressure. A similar situation also developed, although to a much lesser extent, from the ash cooling system, where steam generated from the water used to cool the ash also backed up into the kiln [3].

Public Involvement

- The largest concern of the public was that the incineration system would become a permanent facility and treat waste from other sites. The public was not convinced that such a large amount of money would be spent on a facility which was only temporary. EPA held a series of public meetings with local citizens in an attempt to alleviate their concerns.

REFERENCES

1. Superfund Record of Decision, Sikes Disposal Pits, Crosby, Texas, September 18, 1986.
2. Sikes Disposal Pits Superfund Project Remedial Action Report, Lockwood, Andrews & Newnam, Inc., December 28, 1995.
3. Personal Communication, Mr. Earl Hendrick, USEPA Region VI, April 10, 1997.
4. Successful Completion of the Sikes Incineration Project, James R. Donnelly and Michael Gust, Superfund XV Conference and Exhibition.
5. Correspondence with Mr. Kevin Smith, IT Corporation, April 4, 1997.
6. Personal Communication, Mr. Mike Gust, IT Corporation, May 6, 1997.