On-Site Incineration at the MOTCO Superfund Site Texas City, Texas

Incineration at the MOTCO Superfund Site
Texas City, Texas

Site Name: MOTCO Superfund Site	**Contaminants:** Styrene tars, VOCs, PCBs, and metals: benzene, vinyl chloride, 1,1,2-trichloroethane, lead, cadmium, mercury, and chromium	**Period of Operation:** May 1990 to December 1991
Location: Texas City, Texas		**Cleanup Type:** Remedial action
Vendor: IT Corporation 312 Directors Drive Knoxville, TN 37923 (423) 690-3211	**Technology:** • Two incineration systems: the Hybrid Thermal Treatment System® HTTS-2 and HTTS-3; HTTS-2 designed to process solids, sludges, tars, aqueous wastes, and organic liquids; and HTTS-3 designed to process aqueous wastes and organic liquids • Solids transferred to feed preparation building where materials were mixed and screened • The HTTS-2 consisted of two chambers (the kiln and SCC) and a gas cleaning system consisting of a quench system, gas conditioner, wet scrubber system, and a vane separator; the HTTS-3 consisted of a combustion chamber and a gas cleaning system • Solids, sludges, and aqueous wastes fed to the HTTS-2 kiln by a screw conveyor; organic liquid wastes used as primary fuels in the kiln • Residual ash from kiln collected, landfilled, and capped on site	**Cleanup Authority:** CERCLA and State: Texas • ROD signed 3/15/85 • RP-lead; EPA oversight
SIC Code: 2865 (Industrial organic chemicals)		**Point of Contact:** Ashby McMullan Texas Natural Resources Conservation Commission (512) 239-1000
Waste Source: On site pits - styrene tars and chemical wastes - wood preserving wastes	**Type/Quantity of Media Treated:** Soil, sludge, organic liquids, and aqueous wastes • 10,471 tons aqueous wastes • 7,568 tons organic liquids • 283 tons sludges and tars • 4,699 tons soil	

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Texas City, Texas

(Continued)

Purpose/Significance of Application: Mechanical problems were encountered, caused in part by lack of accurate waste characterization; onsite incineration halted in December 1991 because of dispute between the contractor and RP; remedy changed to off-site incineration in part because of dispute and mechanical problems
Regulatory Requirements/Cleanup Goals: Destruction and Removal Efficiency (DRE) of 99.99% for each principal organic hazardous constituent as required by Resource Conservation and Recovery Act (RCRA) incinerator regulations in 40 CFR part 264, subpart O; 99.9999% DRE for PCBs as required by Toxic Substances Control Act (TSCA) regulations in 40 CFR part 761
Results: Emissions and performance data indicate that all DRE and emissions standards have been met
Description: The MOTCO site was established in 1959 for the recycling of styrene tars. From 1961 to 1968, on-site pits that held styrene tars were used for the disposal of chemical wastes from local industries. In March 1985, a Record of Decision (ROD) that required source control was signed, and in September 1989, a ROD that addressed off-site migration of contaminants was signed. The remedy selected for the first Operable Unit (OU-1) was off-site treatment and disposal of contaminated material; however, the ROD specified that on-site incineration was a viable alternative to be evaluated during the design phase. A later Consent Decree required on-site incineration and established incinerator requirements. The site operated two incineration systems. The first system was called the Hybrid Thermal Treatment System® 2 (HTTS®-2), and the second system was referred to as HTTS-3. The HTTS-2 consisted of a rotary kiln, a secondary combustion chamber (SCC), and a gas cleaning system. This incineration system processed solids, sludges, tars, aqueous wastes, and organic liquids. The HTTS-3 consisted of a combustion chamber and gas cleaning system identical to the SCC and gas cleaning system of the HTTS-2. The HTTS-3 processed only aqueous wastes and organic liquids. In December 1991, the HTTS-3 had passed the trial burn and was performing under interim operating conditions, and the HTTS-2 was in the process of conducting a trial burn when the contractors stopped incineration and filed a lawsuit against the responsible party (RP) for breach of contract. Due to the dispute and several technical problems (including slagging), on-site incineration did not resume. In January 1993, an Explanation of Significant Differences (ESD) specified off-site incineration of the remaining sludges, tars and organic liquid. The remaining soil was to be capped on site. The cost incurred during the on-site incineration was approximately $76 million consisting of $20 million in capital costs and $56 million in operating costs.

EXECUTIVE SUMMARY

This report presents cost and performance data for the application of on-site incineration at the MOTCO Superfund site in Texas City, Texas. Incineration began in May 1990 but was halted in December 1991 by a contractor dispute. Contaminants of concern at the site were PCBs, styrene tars, volatile organic compounds (VOCs), and metals.

The MOTCO site was established in 1959 for the recycling of styrene tars. The recycling was discontinued in 1961 due to damage by Hurricane Carla. From 1961 to 1968, on-site pits that held styrene tars were used for the disposal of chemical wastes from local industries. In March 1985, a Record of Decision (ROD) that required source control was signed, and in September 1989, a ROD that addressed off-site migration of contaminants was signed. This report addresses the incineration specified in the first ROD, unless otherwise stated.

The remedy selected for the first Operable Unit (OU-1) was off-site treatment and disposal of contaminated material; however, the ROD specified that on-site incineration was a viable alternative to be evaluated during the design phase. A later Consent Decree required on-site incineration and set incinerator requirements including a destruction and removal efficiency (DRE) of 99.99% for each principal organic hazardous constituent (POHC) and 99.9999% for polychlorinated biphenyls (PCBs).

The site operated two incineration systems. The first system was called the Hybrid Thermal Treatment System® 2 (HTTS®-2), and the second system was referred to as HTTS-3. The HTTS-2 consisted of a rotary kiln, a secondary combustion chamber (SCC), and a gas cleaning system. This incineration system processed solids, sludges, tars, aqueous wastes, and organic liquids. The HTTS-3 consisted of a combustion chamber and gas cleaning system identical to the SCC and gas cleaning system of the HTTS-2. The HTTS-3 processed only aqueous wastes and organic liquids.

In the rotary kiln, organic compounds from the contaminated material were volatilized and destroyed. The exhaust gases were channeled to the SCC. The SCC provided further combustion of organics in the off-gases, which were then water quenched. Waste oils were used as fuel in the kiln and SCC of the HTTS-2 and in the combustion chamber of the HTTS-3.

The gas cleaning systems for both incineration systems consisted of a quench system, a gas conditioner, a wet scrubber, and a vane separator. The quench system and gas conditioner removed particulate and acid gas. Caustic solution was sprayed into the gas stream in the wet scrubber for particulate matter and acid gas removal, and the solution was then removed from the gas stream by the vane separator.

In December 1991, the HTTS-3 had passed the trial burn and was performing under interim operating conditions, and the HTTS-2 was in the process of conducting a trial burn when the contractors stopped incineration and filed a lawsuit against the responsible party (RP) for breach of contract. Due to the dispute and several technical problems (including slagging), on-site incineration did not resume.

In January 1993, an Explanation of Significant Differences (ESD) specified off-site incineration of the remaining sludges, tars and organic liquid. The remaining soil was to be capped on site.

The cost incurred during the on-site incineration was approximately $76 million consisting of $20 million in capital costs and $56 million in operating costs.

SITE INFORMATION

Identifying Information

MOTCO Superfund Site
Texas City, Texas

CERCLIS # TXD980629851

ROD Date: March 15, 1985 (OU-1)

Treatment Application

Type of action: Remedial (on-site incineration)

Period of incinerator operation: May 1990 - December 1991

Quantity of material treated during application: 10,471 tons of aqueous wastes, 7,568 tons of organic liquids, 283 tons of sludges and tars, and 4,699 tons of soil

Background

Historical Activity that Generated Contamination at the Site: Recycling styrene tars and disposal of petrochemical wastes

Corresponding SIC Code: 2865 Industrial organic chemicals

Waste Management Practice That Contributed to Contamination: Disposal of wastes is unlined surface impoundments

Site History:

- The MOTCO site is located on the Gulf Coastal Plain at the edge of a coastal marsh system.
- The site is within 1/4 mile of the habitats of four endangered species in Texas (the Brown Pelican, the Arctic Peregrine Falcon, the Attwater’s Prairie Chicken, and the American Alligator) as listed in Endangered Species of Texas and Oklahoma 1980. [2]
- The site recycled styrene tars from 1959 until 1961 when flood waters from Hurricane Carla inundated pits containing the styrene tars. The pits on the site were then used until 1968 for disposal of chemical wastes from local petrochemical industries [12].
- During this period, various solvent wastes were disposed of in seven unlined waste disposal pits. An estimated 500,000 gallons of material was disposal of; some of this material was removed during attempts at waste recycling in the 1970s [13].
- The pit contained four layers of source material: surface pit water (aqueous waste), organic liquids, sludges and tars, and soil. The aqueous waste was acidic and contained metals and organics. The organic liquid was ignitable and the primary contaminants were PCBs. The sludge/tar layer and the soil contained styrene tars, VOCs, and metals [1].
- In 1980, the U.S. Coast Guard removed drums, extended a dike around the perimeter of the pits, and erected a fence around the pits. EPA conducted three emergency response actions (September 1981; March 1983; and September 1983) to treat and discharge excess aqueous liquid caused by heavy rainfall [3].
- Two site investigations were conducted in 1981-82 and a Feasibility Study (FS) was completed in September 1984.
- The contaminated materials to be incinerated were located in seven unlined pits covering a surface area of approximately 4.6 acres. The OU-1 ROD estimated that 62,200 tons of aqueous wastes, 13,920 tons of sludges/tars, and 31,950 tons of soil would require incineration.

SITE INFORMATION (CONT.)

Background (Cont.)

- Incineration began in May 1990, but ended in December 1991 when the remedial contractors filed suit against the RP for breach of contract. The dispute involved several operational problems discussed later in this report under Lessons Learned.
- In the time that the on-site incinerators operated, 10,471 tons of aqueous wastes, 7,568 tons of oil, 283 tons of sludges/tars, and 4,699 tons of soil were incinerated. When on-site incineration ceased, it was estimated that approximately 8,100 tons of organic liquid, 10,100 tons of sludges/tars, and 61,600 tons of soil remained at the site [12]. All PCB-contaminated organics had been incinerated by this time.

Regulatory Context:

- In July 1982, the MOTCO site was placed on the National Priorities List (NPL).
- An OU-1 ROD was signed in March 1985, specifying source control by incineration of organic liquids on site or off site; biological treatment of pit surface water and/or on-site incineration; and off-site landfilling of sludges, tars, and soils or on-site incineration [3].
- In 1987, EPA and the RP entered into a Consent Decree. At that time, the alternative of on-site incineration was selected.
- The OU-2 ROD was signed in September 1989, specifying management of migration by incineration of dense, nonaqueous phase liquids (DNAPLs), treatment of contaminated ground water, and consolidation and capping of slightly contaminated surface soils [4].
- During the design phase for the OU-2 remedy, EPA determined that long-term management of the site was necessary. The complete removal of all contaminated material associated with OU-1 was deemed no longer essential; therefore contaminated soils were left on site to be incinerated by the OU-2 remedy [12].
- EPA prepared an Explanation of Significant Differences (ESD) in January 1993, specifying off-site incineration of liquids and sludges/tars and capping of contaminated soils [12].
- The remedial standards applied at MOTCO were based on the following laws, regulations, and policies: the Toxic Substances Control Act (TSCA) and associated regulations in 40 CFR part 761, Executive Order 11990 (Protection of Wetlands), Executive Order 11988, (Floodplain Management), and the Resource Conservation and Recovery Act (RCRA) and associated regulations in 40 CFR part 264, subpart O [3].
- Site activities were conducted under provisions of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and the National Contingency Plan (NCP) 40 CFR part 300 [12].

Remedy Selection: On-site rotary kiln incineration was selected as the remedy for the contamination at the MOTCO site based on the results of the RI/FS, two site investigations, a responsiveness summary, and long-term economic considerations [3].

SITE INFORMATION (CONT.)

Timeline

Table 1. Timeline [2]

Date	Activity
1959 - 1968	Operations were performed at the MOTCO site
1981	Initial site investigation performed
1982	Second site investigation conducted
July 1982	Site placed on the NPL
September 1984	Feasibility Study completed
March 1985	Record of Decision for OU-1 signed
October 1987	EPA entered into a Consent Decree with a number of Potentially Responsible Parties
October 1990	Trial Burn for second incineration system (HTTS-3)
May 1990 - December 1991	Incineration occurred on site
December 1991	Contractor stopped incineration and filed suit against RP
January 1993	ESD specified off-site incineration as new remedial action for liquids and sludges/tars with capping of contaminated soil.

Site Logistics/Contacts

Site Management: RP-Lead

Oversight: EPA

Remedial Project Manager:
Carlos Sanchez
U.S. EPA Region 6
1445 Ross Avenue, Suite 1200
Dallas, TX 75202
(214) 665-8507

State Contact:
Ashby McMullan
Texas Natural Resources Conservation Commission
(512) 239-1000

Treatment System Vendor:
IT Corporation
312 Directors Drive
Knoxville, TN 37923
(423) 690-3211

MATRIX DESCRIPTION

Matrix Identification

Type of Matrix Processed Through the Treatment System: Soils, sludges, tars, organic liquids, and aqueous wastes were removed from unlined pits.

Contaminant Characterization

Primary Contaminant Groups: Styrene tars, VOCs, PCBs and metals.

- The contaminants of greatest concern were styrene tars, benzene, vinyl chloride, 1,1,2-trichloroethane, lead, cadmium, mercury, and chromium.
- The maximum concentrations of selected organic constituents and metals in the pit wastes were 22,000 mg/kg of styrene, 61,000 mg/kg of 1,1,2-trichloroethane, 41,500 mg/kg of 1,2-dichloroethane, 7,600 mg/kg of vinyl chloride, 5,440 mg/kg of benzene, 12,000 mg/kg of aluminum, 920 mg/kg of cadmium, 550 mg/kg of chromium, and 46,000 mg/kg of lead.

MATRIX DESCRIPTION (CONT.)

Matrix Characteristics Affecting Treatment Cost or Performance

The major 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 of Aqueous Waste Feed [5]

Parameter	Value
Heat Content	57 BTU/lb
Density	1.003 g/ml
Ash Content	0.59%
Organic Chlorine	0.048%

The matrices most affecting cost were the viscosity and heat content of the oils and sludges. For example, the heat content of the as-encountered waste exceeded the as-characterized waste by 40 percent, and the as-encountered waste viscosity substantially exceeded the as-characterized viscosity. This required the majority of the waste feed to be treated in the smaller HTTS-2 kiln instead of in the two SCC chambers as originally planned. The net result was that the equipment on site had excess capacity for treating pumpable sludges and insufficient capacity to treat solid sludges and soils. Hence, the project was not as economical as had originally been planned.

TREATMENT SYSTEM DESCRIPTION

Primary Treatment Technology

HTTS-2:

- Rotary kiln; and
- Secondary combustion chamber (SCC).

HTTS-3:

- Combustion chamber

Supplemental Treatment Technology

Pretreatment (solids): Shredded and Mixed

Post-Treatment (air) for both HTTS-2 and HTTS-3, including:

- Quench system;
- Gas conditioner;
- Wet scrubber hydro-sonic tandem nozzle scrubber system; and
- Vane separator.

Post-Treatment (water): Filtration in a closed-loop system

System Description and Operation

- Two incineration systems were designed for use at the MOTCO site: HTTS-2 and HTTS-3. The HTTS-2 was designed to process solids, sludges, tars, aqueous wastes, and organic liquids. The HTTS-3 was designed to process only aqueous wastes and organic liquids.

- Organic liquids, aqueous waste, and pumpable sludge were transferred to dedicated tanks before being fed to the incineration systems. Any solids were prepared in the feed preparation building where materials were mixed to provide a homogeneous matrix, then screened. Oversized material was shredded and remixed.

TREATMENT SYSTEM DESCRIPTION (CONT.)

System Description and Operation (Cont.)

- The HTTS-2 employed at the MOTCO site consisted of two chambers (the kiln itself and the SCC) and a gas cleaning system consisting of a quench system, gas conditioner, wet scrubber system, and a vane separator. The HTTS-3 consisted of a combustion chamber and a gas cleaning system that were identical to the SCC and gas cleaning system of the HTTS-2.

- Solids, sludges, and aqueous wastes were fed to the HTTS-2 kiln by a screw conveyor designed to minimize air infiltration, and the sludges and aqueous waste were pumped from separate tanks through separate lances into the kiln. Organic liquid wastes were used as primary fuels in the kiln.

- The HTTS-2 kiln was a carbon steel chamber that measured 45 feet long, with an outer diameter of 7 feet, 7 inches, an inner diameter of 6 feet, 6 inches, and a volume of 1,540 cubic feet. The kiln was lined with a 6-inch-thick layer of super-duty refractory brick. The kiln was rated at 40 million BTU/hr. The kiln was of countercurrent design and was capable of operating in either an oxidative mode or a combined oxidative and reductive mode, depending on the waste feed.

- The aqueous wastes and organic liquid wastes were injected into the HTTS-3 combustion chamber burners through air-atomized burner guns. Organic liquid wastes were also used as primary fuels for the SCC and the HTTS-3 incineration chamber main burners.

- The SCC for the HTTS-2 and the combustion chamber for the HTTS-3 were down-fired steel chambers. The chambers were lined with 7 to 9 inches of refractory insulating material and were approximately 52 feet tall with an outer diameter of 12 feet. The units operated at a minimum of 3 percent excess oxygen with a 2-second off-gas retention time.

- Residual ash from the kiln was collected and was to be landfilled and capped on site, but disposal of the ash did not occur before the contractors stopped incineration and filed the lawsuit. Disposal of ash was addressed by the subsequent ESD.

- The exhaust gases from the HTTS-2 SCC and the HTTS-3 combustion chamber were directed through separate but identical gas cleaning systems. First, the gases were routed to the quench system for cooling and removal of particulate matter and acid gas. Flue gas from the quench system then flowed into the gas conditioner, where additional particulate matter and acid gas were removed.

- Gas leaving the gas conditioner entered the first of two Hydro-Sonic® subsonic nozzles where caustic solution was sprayed into the gas stream. The gas stream then passed through a mixing tube to the second Hydro-Sonic® subsonic nozzle for additional treatment.

- The gas stream passed through a second mixing tube before entering the vane separator, where the spray solution from the scrubber was removed.

- Combustion gases were drawn through the incineration system by an induced draft fan (resulting in a constant negative pressure throughout the system) and were exhausted through an 80-foot fiberglass reinforced plastic stack.

- Both systems had an emergency relief vent system to treat off-gases from the kiln during emergency shutdowns. The Environmentally Safe Temporary Emergency Relief System® (ESTER®) received electricity from a battery-powered uninterruptable power source, so the off-gases were treated even during power outages. The ESTER system consisted of a natural gas ring burner, two continuous gas pilots, and two natural draft air dampers. The system was designed to be a complete stand-alone combustion system in emergency shutdown situations [5].

TREATMENT SYSTEM DESCRIPTION (CONT.)

Table 3. Summary of Operating Parameters

Parameter	Value
Residence Time (Solids)	15 to 90 minutes
System Throughput	NA
Kiln Exit Temperature	800°-1800°F

TREATMENT SYSTEM PERFORMANCE

Cleanup Goals/Standards

- The cleanup goals and standards were specified by the Consent Decree. The DRE and ash residual standards were set based on regulations under TSCA in 40 CFR part 761, subpart D.
- The pits were to be excavated to the sludge/soil interface and to a depth of one foot below the sludge/soil interface. The sludge/soil interface was identified visually by the personnel performing the excavation [3].
- Cleanup levels had to conform to a level that presented a lifetime increased cancer risk of 1×10^{-6} or less.
- Applicable or relevant and appropriate requirements (ARARs) required a DRE of 99.99 percent for POHCs and 99.9999 percent for PCBs.
- The management of residual ash from on-site incineration was addressed by the second consent decree that specified off-site incineration.

Treatment Performance and Compliance

- The trial burns conducted at the MOTCO site were designed to operate the incineration system at conditions that would reflect worst-case destruction and removal of all constituents of concern.
- Naphthalene, 1,1,2-trichloroethane, and carbon tetrachloride were selected as the POHCs for the MOTCO site.
- The MOTCO site was required to demonstrate a 99.9999 percent DRE for PCBs. However, the concentration of PCBs was not sufficient to demonstrate this DRE. Therefore, the DREs for 1,1,2-trichloroethane and carbon tetrachloride were demonstrated to be greater than 99.9999 percent rather than the 99.99 percent specified [5].
- Before the trial burn for HTTS-3, the wastes were analyzed and a 10 percent spike of 1,1,2-trichloroethane and a 10 percent spike of carbon tetrachloride were added to the organic liquids. Concentrations of naphthalene were measured and were deemed high enough so that spiking was not necessary.

TREATMENT SYSTEM PERFORMANCE (CONT.)

Treatment Performance and Compliance (Cont.)

- The AWFCO limits for the incinerator are shown in Table 4. Information about the frequency of AWFCOs was not available.

- The HTTS-3 had completed a trial burn and was running under interim standards and the HTTS-2 was in the process of conducting a trial burn when on-site incineration ceased as the result of a dispute between the RP and the contractor. The chemical makeup, quantities, and mixture of the waste were found to be different than initially estimated. As a result, the incineration systems were not properly designed for the actual waste. A number of technical difficulties were experienced with the systems, including slagging, particulate carryover, dust blocking the flame detector in the kiln, and low utility fuel gas pressure.

- Several problems that caused the dispute are presented in the Lessons Learned section of this report.

Table 4. Proposed Automatic Waste Feed Cutoffs for HTTS-2 and HTTS-3

Parameter	Cutoff Limit
Minimum rotary kiln temperature	900°F
Minimum secondary combustion chamber temperature	2,020°F
Maximum kiln solid/sludge/aqueous flow (HTTS - 2 only)	20 tons/hr
Maximum kiln organic liquid flow (HTTS - 2 only)	2,500 lb/hr
Maximum SCC organic liquid flow	7,300 lb/hr
Maximum SCC aqueous waste flow	9,700 lb/hr
Maximum kiln pressure (15 second delay) (HTTS - 2 only)	0 inches w.c.
Maximum quench chamber temperature	220°F
Minimum gas cleaning system pressure drop	35 inches w.c.
Maximum stack gas carbon monoxide concentration (1-hour rolling average) corrected to 7 percent oxygen	100 ppm
Minimum stack gas oxygen concentration	3 vol % dry
Maximum stack gas flow (1 hour rolling average)	55,000 acfm

TREATMENT SYSTEM PERFORMANCE (CONT.)

Performance Data Completeness

- A list of contaminants detected in the various matrices at the site is available in the Initial Investigation [1].

Performance Data Quality

- According to site personnel, the Quality Assurance/Quality Control (QA/QC) program used throughout the remedial action met the EPA and the State of Texas requirements.

TREATMENT SYSTEM COST

Procurement Process

- The RP contracted with IT Corporation to conduct the remedial work.

Cost Data

- The total capital cost exceeded $20 million. In the time that the incineration systems were operated, the contractor spent approximately $56 million in operating and maintenance costs. The initial bid for on-site incineration was $30 million, and at the time the contractors stopped incineration and filed the lawsuit, the RP had paid the contractor $20 million. The total cost to complete the on-site incineration was estimated to be $110 million. A total of 23,021 tons of material -- including soil sludge, organic liquid, and aqueous waste -- were incinerated. This corresponds to a total unit cost for incineration of $3,300 per ton.

Cost Data Quality

- Cost data was acquired through personal communications between IT and EPA and between the RP and EPA.

OBSERVATIONS AND LESSONS LEARNED

Cost Observations and Lessons Learned

- The initial profile of the contamination on site was inaccurate. Therefore, the incineration systems that were designed were not optimal for the wastes. This resulted in a large increase in clean-up time and cost. The contractor interpreted the waste characterization data to show principally pumpable organic waste suitable for direct firing in an SCC, and subsequently mobilized two SCCs with one small kiln. In actuality, most of the waste was solid in nature and needed to be fed to the kiln. Hence, the two incinerators did not provide feed systems suitable to the actual on-site waste.

OBSERVATIONS AND LESSONS LEARNED (CONT.)

Other Observations and Lessons Learned

- The MOTCO site had several technical problems with the incineration systems, one of which was slag buildup and plugging in the bottom of the HTTS-2 SCC. According to site personnel, a possible solution would have been to discharge the ash while it was still hot and quench and cool the ash and slag outside of the SCC. A key cause of the slag build-up was the high gas velocity in the HTTS-2 kiln due to increased feed rates for soils and sludges. The resulting high gas velocities carried particulates into the HTTS-2 SCC.
- Another problem was excessive particulate carryover from the air pollution control system. Fine particulate was produced in the quench due to the high chlorine content of the waste and the use of a saturated brine crystallizer system to remove salt from recirculating quench wastes. A water/steam "supersub" was placed in the first hydro scrubber to address this problem.
- Slide valves in the incineration systems were used to isolate certain areas during incineration. A workman at the MOTCO site was killed when removing timbers that had been used to block open a slide valve during internal maintenance. Any designs utilizing slide valves should incorporate devices that will safely keep valves open.
- Almost a third of the shutdowns at the MOTCO site were due to incinerator dust blocking the flame detector. The detector would signal that the kiln burners were extinguished and then shut down the system.
- Another problem was caused by an electrical switchgear in the induced draft fan overheating by operating at peak capacity in the Texas heat. Site personnel stated that sensitive electrical equipment should be protected from such weather by air-conditioned and heated buildings or other means [14].
- Low utility fuel gas pressure caused several problems. Site personnel felt that an oversized gas line would have improve the utility fuel gas pressure.

Public Involvement

- A community involvement plan was developed in 1987 and revised in 1989. Two open houses and workshops were held in November 1990 and October 1993. EPA held public meetings for the source control ROD and the management of migration ROD in January 1986 and July 1989, respectively. Starting in 1987, several fact sheets were sent to 270 citizens on the site mailing list.
- A high level of organized interest existed in the community regarding the cleanup of the site. Many concerns voiced were regarding air emissions during the trial burns and the litigation between the RP and their contractor [13].

REFERENCES

1. Initial Investigation of MOTCO Hazardous Waste Disposal Site, Final Report, Black & Veatch Consulting Engineers, December 23, 1981.

2. Source-Control Feasibility Study: MOTCO Site, LaMarque, Texas, CH2M Hill, September, 1984.

3. Superfund Record of Decision Operable Unit 1, MOTCO, Texas City, Texas, March 15, 1985.

4. Superfund Record of Decision Operable Unit 2, MOTCO, Texas City, Texas, September 27, 1989.

5. MOTCO Site Remediation and Incineration Project Trial Burn Report for HTTS-3, IT Corporation, February, 1991.

6. Personal Communication between E.F. Stecher of the MOTCO Trust Group and U.S. EPA Region 6, November 5, 1991.

7. Complaint: IT Corporation v MOTCO Site Trust Fund and Monsanto Company, The United States District Court for the Southern District of Texas, Houston Division, December 3, 1991.

8. IT Corporation News Release, Houston, December 4, 1991.

9. Personal Communication between Frances E. Phillips of Gardere & Wynne and U.S. EPA Region 6, December 17, 1991.

10. Personal Communication between R.E. Guilliams of the MOTCO Trust Group and U.S. EPA Region 6, December 5, 1991.

11. Personal Communication between R.E. Guilliams of the MOTCO Trust Group and U.S. EPA Region 6, December 19, 1991.

12. Explanation of Significant Differences, MOTCO Superfund Site, LaMarque, Galveston County, Texas, January 13, 1993.

13. EPA Region 6 Superfund Homepage, Internet,(http://www.epa.gov/earth1r6/6sf/motco.pdf) March 28, 1997.

14. Personal communication with Carl Edlund, U.S. EPA Region 6, May 15, 1997.