United States Environmental Protection Agency

Risk Reduction Engineering Laboratory Cincinnati, OH 45268

Research and Development

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EPA

# Project Summary

# EPA Mobile Incineration System Modifications, Testing and Operations – February 1986 to June 1989

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**The report summarized here covers the field demonstration activities of the U.S. Environmental Protection Agency's (EPA's) Mobile Incineration System (MIS) from February 1986 to June 1989 at the Denney Farm site, Missouri. These activities were the culmination of a project sponsored by the EPA Office of Research and Development, Office of Solid Waste and Emergency Response, and Region VII to demonstrate the feasibility of incinerating hazardous wastes on-site in mobile incineration systems. The initial part of the field demonstration was discussed in an earlier Project Summary and associated report.***

**The activities discussed in the current report include: modifications made to the MIS to double its capacity and to improve its reliability; the 1987 trial burn for Resource Conservation and Recovery Act (RCRA) and Toxic Substances Control Act (TSCA) wastes; tests to show the feasibility of processing brominated sludge and canceled pesticides, including testing for metals emissions; delisting tests for the brominated sludge; site and incinerator closure activities; and the accomplishments, problems encountered, and solutions implemented during the operation of the MIS. In addition, a system availability analysis is presented. The information contained in the full report is of benefit to those in the public sector who are considering or are currently applying incineration technology as a remedial alternative.**

***This Project Summary was developed by EPA's Risk Reduction Engineering Laboratory, Cincinnati, OH, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).***

## Introduction

The development of the EPA MIS began in the mid-1970s as a research effort to demonstrate the ability to incinerate oil and hazardous materials on-site. After several years of design and construction, shakedown testing of the unit began in 1981. The MIS successfully demonstrated its capability for incinerating PCBs and other chlorinated organic liquids in trial burn tests conducted in New Jersey in 1982 and 1983. Upon successful completion of these tests, the MIS was modified to handle solid waste materials and was subsequently brought to the Denney Farm site in southwestern Missouri for a field demonstration. The purpose of the MIS field demonstration was to demonstrate the feasibility of using mobile incineration for the on-site treatment and disposal of hazardous wastes.

The Denney Farm site was one of eight southwestern Missouri sites con-

* "Destruction of Dioxin Contaminated Solids and Liquids by Mobile Incineration," EPA/600/S2-87/033, NTIS PB87 188512/AS.

taminated with 2,3,7,8-tetrachlorodibenzo(p)dioxin (2,3,7,8-TCDD) and related compounds. Successful completion of the dioxin trial burn conducted in April 1985 allowed the MIS to become the first fully-permitted hazardous waste treatment facility for dioxin in the United States. In addition, the delisting tests conducted at that time declared the ash and water generated during incineration of dioxin-contaminated soils in the MIS to be nonhazardous. Between 1985 and 1989, the incinerator treated over 12,500,000 lb of solids and 230,000 lb of liquids from the eight southwestern Missouri dioxin sites.

The field demonstration, which began in July 1985, was suspended in February 1986 pending reauthorization of Superfund. When funding from the Superfund became available, modifications were made to the system before the start of operations. These modifications improved the system's on-line factor and capacity. Shakedown testing of the modified system was conducted and operations resumed during the summer of 1987. From that time until April 1989, the incinerator treated the remaining dioxin-contaminated materials from the eight southwestern Missouri dioxin sites. In addition to processing these wastes, a trial burn, delisting tests, feasibility tests of brominated sludge and vermiculite, and metals emissions tests were successfully conducted. These activities are all discussed in the project report.

The results of the all trial burns conducted on the MIS and engineering data showing the final configuration of the MIS are presented in the fact sheets included in this Project Summary.

## System Modifications

Major modifications were installed on the system during 1987 before the restart of operations. In addition, some system modifications were made during maintenance periods in 1988. The modifications and resulting improvements to the system are discussed below.

The incorporation of a Linde "A"®* Oxygen Combustion System in the rotary kiln was primarily responsible for increasing the MIS capacity for treating soils by more than a factor of two. This was the first application of oxygen in a hazardous waste incineration system. The microprocessor-based controls of the oxygen system have exhibited excellent response, which has reduced the number of feed shutdowns due to low oxygen and high carbon monoxide contents in the stack gas.

Modifications to the air pollution control system consisted of adding a cyclone, replacing the Cleanable High Efficiency Air Filter (CHEAF) with a wet electrostatic precipitator (WEP), and adding a Monarch® CPI separator. The cyclone alleviated the problem of particulate accumulation in the secondary combustion chamber (SCC). The frequent clean-outs of the accumulation, which previously occurred on a weekly basis, and the associated downtimes were almost eliminated. The unit was able to operate over a period of several months before a clean-out was required. The WEP demonstrated excellent performance in particulate removal and solved the extensive maintenance requirements associated with the CHEAF. The WEP did, however, have a tendency to occasionally short out, causing some downtime. The Monarch® CPI separator minimized the suspended particulate matter in the process water system and required little maintenance.

Modifications to the feed system consisted of increasing the size of the ram feed trough and adding a conveyor belt system, an adjustable roller, and a television camera. The larger trough helped to increase the system's capacity by increasing the amount of material entering the kiln with each stroke of the ram. The conveyor belt system, which was installed in March 1988 and was used to feed material to the shredder, successfully increased production by reducing the frequency of handling feed materials. This permitted sustained feeding of material at twice the original feed rates. An adjustable roller installed in the feed system in January 1988 reduced the frequency and severity of feed system blockages. A television camera placed at the discharge end of the conveyor belt provided prompt detection of feed system jams. These modifications increased the reliability of the MIS.

Other modifications that improved reliability were redesigning the ash gates and the SCC exit. The repair and redesign of the ash gates reduced slagging incidents. Replacement of the metal venturi SCC outlet with a refractory-lined outlet duct eliminated the frequent failures in this area of the MIS.

A mist eliminator was installed in the MX scrubber to reduce the particulate emissions, which was necessary at high organic halide loadings. Knock-out ports installed in the ducts between the rotary kiln and SCC permitted hot clean-outs of ash deposits that accumulated in these areas when the MIS processed brominated sludge. The ability to clean out the ducts without needing to first cool down the system minimized the interruption in operation. The hot clean-out took minutes to complete, whereas a cold clean-out took days.

## Shakedown and Compliance Testing on Modified System

A series of tests including the RCRA/TSCA trial burn showed that the MIS could process almost any organic hazardous waste in an environmentally acceptable manner. These tests were conducted as a research effort and also in an effort to qualify for a permit that would allow the MIS to incinerate the canceled pesticides, 2,4,5-T and silvex, and a dioxin-contaminated brominated sludge.

The trial burn for both the RCRA and TSCA compounds was conducted during the summer of 1987. The principal organic hazardous constituents (POHCs) for the trial burn that were regulated under RCRA were carbon tetrachloride, hexachloroethane, and trichlorobenzene, which are among the most difficult RCRA compounds to incinerate. PCBs were the TSCA POHCs. This trial burn demonstrated the MIS's ability to exceed the required 99.9999% destruction and removal efficiency (DRE) for PCBs and the required 99.99% (DRE) for the RCRA compounds.

A series of tests were conducted with brominated sludge and with mixtures of brominated sludge, soil, and sodium sulfate ($Na_2SO_4$) to determine the composition most suitable for feeding. These tests showed that it was best to incinerate pure brominated sludge, and they determined the proper operating conditions for this difficult-to-incinerate material. The critical operating conditions defined by the tests were: a low 0.8 rpm kiln rotation speed to provide adequate solids residence time for burn-out; a kiln temperature of 1650°F to 1700°F to maintain ignition and prevent combustion oscillations; and water injection to control kiln temperature and maximize throughput.

As a result of slagging in the kiln and troublesome ash deposits in the duct system, tests to ascertain the ash fusion characteristics and chemical analyses of the slag and ash deposits were conducted. The results of the tests showed that slagging was promoted when sodium and potassium content of the ash exceeded 3.5 wt% and that troublesome

* Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

ash deposits occurred when the ash contained large quantities (50 wt%) of calcium and sulfur.

A metals testing program was conducted to determine the quantity of metals being emitted from the stack during incineration of the brominated sludge because of its high content of lead, chromium, and other metals. The tests showed that the metal emissions were below the Tier II emissions screening levels presented in the proposed amendments to the hazardous waste incinerator regulations. Since the Tier II emission levels are health based, this finding showed that health risks from metal emissions were acceptable.

Testing of heavy metals emissions and of the residue streams showed how mercury, cadmium, lead, arsenic, hexavalent chromium and total chromium were partitioned among the various residue streams. Mercury did not appear in the kiln or cyclone ash in measurable quantities and was probably volatilized. A small amount was captured by the air pollution control system and wound up in the separator sludge. Most of the mercury measured was found in the particulate portion of the stack effluent at concentrations that were 90 times those in the original feed material. Most of the lead and cadmium were volatilized and, after condensation, were contained in the separator sludge. Furthermore, the concentrations of lead, cadmium, and mercury in the separator sludge and the stack were an order of magnitude higher than in the other solid residue streams. Total chromium concentrations were approximately the same in all solid streams, but significant levels of hexavalent chromium were found only in the cyclone ash.

Delisting tests for the residues generated during incineration of the brominated sludge were conducted. These tests showed that residual concentrations of less than 15 parts per trillion of dioxin in the solid residue and less than 120 parts per quadrillion of dioxin in the scrubber water were achievable.

## Operating Experiences

The operation of the MIS has shown constant improvement as engineering solutions to the operating problems have been applied. From 1985 to 1989, capacity was doubled from 2000 lb/hr to 4000 lb/hr, and the system availability increased from 40% to 80%.

The increased capacity and reliability greatly reduced incineration costs between 1985 and 1989. During closure, materials were processed for $1100/ton compared with a $2800/ton cost for similar materials at the start of operations in 1985. Since incineration costs are directly related to throughput, however, they were widely variable. Materials with high heat contents cost more to process because of the low processing rates achievable with these feeds. Note that these costs do not reflect costs of doing mobile incineration commercially; this project was one task conducted under an EPA research contract. The relative costs of the various operating periods are significant.

The performance capabilities of the MIS on a variety of feed materials have been ascertained. Operational experience during 1987, 1988, and 1989 has shown that feed rates vary widely depending on the feed characteristics. Relatively dry soil (less than 20% moisture) could be processed at 4000 lb/hr. Feed moisture contents of about 35% produced muddy soil that could be fed at only 2000 lb/hr. The heat and moisture contents as well as slagging tendencies of the feed material were the most important variables affecting feed rates. With a 2650 BTU/lb minimum heat content, brominated sludge could be incinerated at only 2000 lb/hr. Pure trash with a heating value up to 18,000 BTU/lb could only be processed at rates of 200 lb/hr.

## Denney Farm Site and MIS Closure

The closure at the Denney Farm site provides a benchmark example for the clean closures of other incinerator sites. Closure at Denney Farm entailed decontamination of Denney Farm soil, decontamination of the hot zone buildings used for storage and handling of hazardous waste, decontamination of hot zone equipment, decontamination of the feed system, and disassembly and transport of the MIS. Target compounds and the associated action levels were approved by the Missouri Department of Natural Resources.

The initial closure activities involved sampling and analysis of the site soils to determine the extent of contamination. The data showed that contamination had spread to areas outside the hot zone. The contaminated soils from inside and outside the hot zone were excavated and incinerated.

Lessons learned from this movement of contamination are as follows:

- The number of waste handling steps should be minimized to prevent spillage of the material, and contaminated material should only be handled within diked areas.
- The hot zone areas should be graded so that rainwater cannot carry contamination into clean areas.
- Periodic sampling of the site should be conducted to identify contamination and thus permit prompt action to prevent its spread.

Equipment and buildings on the site were wipe tested to determine the extent of contamination. All contaminated equipment was decontaminated and wipe tested before leaving the site. This procedure ensured that all equipment leaving the site from both inside and outside the hot zone was free of contamination. The individual components of the buildings (sheet metal walls, concrete foundations, and wood framework) were sampled separately because of their different action levels. The contaminated building and equipment surfaces were decontaminated by scrubbing with brushes and rinsing with high pressure water or steam cleaning. This was preceded by scraping when necessary.

The MIS was disassembled to the degree that all components could be mounted on over-the-road equipment and transported. The equipment was transported to the EPA Edison, New Jersey, facility in May and June 1989. The government-owned equipment required a total of 21 trailers for transport.

## Recommendations

EPA does not plan to sponsor further field demonstration of the MIS. EPA is, however, seeking a technology partner to sponsor further development of the MIS under the Federal Technology Transfer Act (FTTA). This law allows the federal government to seek a technology partnership with a commercial or other governmental organization for further development of such equipment to advance the state of the knowledge. Should the MIS be operated again under the FTTA, the following modifications can be made to improve the economics of the system by reducing the number of operators and utility costs:

1. Automate ash handling.
2. Consolidate all controls into a central control room. This should include the Continuous Emission Monitoring equipment.
3. Install a larger quench sump to ensure sufficient water holdup for all the pumps, quench elbow, and WEP.

The full report was submitted in fulfillment of Contract 68-03-3255 by Foster Wheeler Enviresponse, Inc., under the sponsorship of the U.S. Environmental Protection Agency.

## MIS Facts

Following is a summary of facts and figures pertaining to the operation of the EPA Mobile Incineration System. Included in this summary are the operating conditions for the system, drawings of its major components, its overall dimensions and utility requirements, and the results of its various trial burn tests.

### *U.S. EPA Mobile Incineration System Facts and Figures*

*Description and Operating Summary*

| Description | Operating Summary | Kiln | Cyclone | SCC | Quench | Stack |
|---|---|---|---|---|---|---|
| *Overall Length:* 150 ft | *Temperature (°F)* | 1450 | 1450 | 2200 | 195 | 175 |
| *Stack Height:* 40 ft | *Pressure (in w.c.)* | -0.3 | -2.5 est | -3.0 | -7.0 | -15 at fan |
| *Overall Heat Duty:* 13.5 MMBTU/hr | *Gas Residence Time (sec)* | 3.0 | 1.5 est | 2.0 minimum | NA | NA |
| *Electrical Requirements:* 130 KW | | | | | | |
| | Feed Rates: | | | | | |
| | *Air (SCFM)* | 560 | NA | 1200 | NA | 500 (leakage) |
| | *Oxygen (SCFM)* | 118 | NA | NA | NA | NA |
| | *Fuel Oil (gph)* | 41 | NA | 60 | NA | NA |
| | *Waste Solids (lb/hr)* | 4000 | NA | NA | NA | NA |
| | *Waste Oil (lb/hr)* | 150 | NA | NA | NA | NA |
| | *Water (gpm)* | 1.5 | NA | NA | 61[1] | NA |
| | Discharges: | | | | | |
| | *Ash (lb/hr)* | 2400[2] | 400[2] | NA | 50 | NA |
| | *Scrubber Water (gpm)* | | | | 2 to 12[3] | |
| | *Flue Gas (SCFM)* | 1150 | 1150 | 2400 | 4300 | 5800 |

*[1] Cooling water injected into Quench area about 10 gpm is evaporated by the SCC flue gas; the remainder is recirculated.*
*2 For a typical soil. This is variable depending on waste characteristics.*
*3 The blowdown was adjusted to maintain 20,000 ppm total dissolved solids at the MX Scrubber. This is variable depending upon the organic halogen and sulfur contents of the waste.*

*Trial Burns*

| Description | DRE Achieved (%) | Particulate Emissions (gr/dscf) | HCl Removal (%) |
|---|---|---|---|
| Initial Tests:[1] *September 1982 through January 1983 (Liquid Wastes Only)* | | | |
| 1. *Diesel Fuel/Iron Oxide for particulates* | NA | 0.011 | NA |
| 2. *Diesel Fuel/Carbon Tetrachloride/Dichlorobenzene* | | 0.029 | 99.95 |
| *Carbon Tetrachloride* | >99.99996 | | |
| *Dichlorobenzene* | >99.99998 | | |
| 3. *PCBs/Trichlorobenzene/Tetrachlorobenzene* | | 0.016 | 99.98 |
| *Trichlorobenzene* | >99.9998 | | |
| *Tetrachlorobenzene* | >99.9994 | | |
| *PCBs as Aroclor 1260* | >99.9998 | | |
| 4. *PCBs/Trichlorobenzene/Tetrachlorobenzene* | | 0.019 | 99.99 |
| *Trichlorobenzene* | >99.99993 | | |
| *Tetrachlorobenzene* | >99.99985 | | |
| *PCBs as Aroclor 1260* | >99.99991 | | |
| Dioxin Trial Burn: *(Solids and Liquids) (February and April 1986)* | | | |
| 1. *2,3,7,8-TCDD Run#2* | 99.99997 | 0.060 | NA |
| 2. *2,3,7,8-TCDD Run#3* | 99.99998 | 0.065 | NA |
| 3. *2,3,7,8-TCDD Run#4* | 99.99999 | 0.065 | NA |
| 4. *2,3,7,8-TCDD Run#5* | 99.99998 | 0.090 | NA |
| 5. *2,3,7,8-TCDD/brominated sludge* | NA | NA | 99.0 |

*[1] The DRE and particulate data are averaged over three test runs.*

## U.S. EPA Mobile Incineration System Facts and Figures

*Trial Burn and Tests*

| Description | DRE Achieved | Particulate Emissions | HCl Removal |
|---|---|---|---|
| RCRA/TSCA Trial Burn: July, August 1987 | | | |
| Run 2 Solids Only | | 0.065 | 99.97 |
| PCBs | 99.9999996 | | |
| Carbon Tetrachloride | | | |
| Low Vost | NA | | |
| High Vost | NA | | |
| 1,2,4-Trichlorobenzene | 99.99991 | | |
| Hexachloroethane | 99.99984 | | |
| Run 3 Solids and Liquids | | 0.066 | 99.98 |
| PCBs | 99.9999995 | | |
| Carbon Tetrachloride | | | |
| Low Vost | 99.99968 | | |
| High Vost | 99.99958 | | |
| 1,2,4-Trichlorobenzene | 99.99968 | | |
| Hexachloroethane | 99.9981 | | |
| Run 5 Solids, Liquids and Trash | | 0.085 | 99.99 |
| PCBs | 99.9999965 | | |
| Carbon Tetrachloride | | | |
| Low Vost | 99.99916 | | |
| High Vost | 99.99869 | | |
| 1,2,4-Trichlorobenzene | 99.99996 | | |
| Hexachloroethane | 99.999976 | | |

*Rotary Kiln*

*Dimensions*

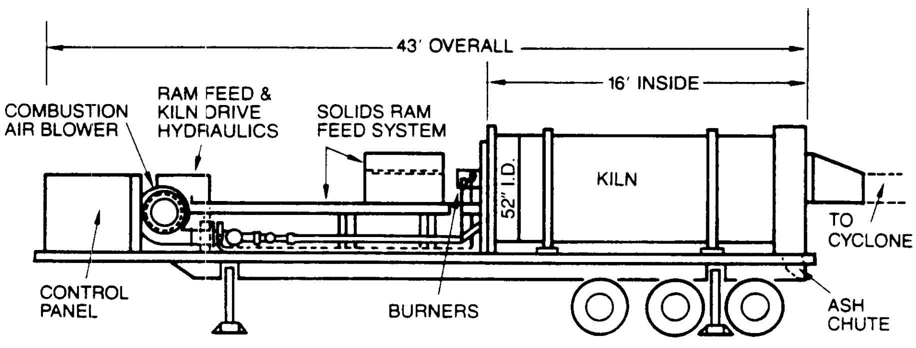
| | |
|---|---|
| Trailer Length (ft) | 45 |
| Kiln Length (ft) | 16 |
| Kiln I.D. (in) | 52 |
| Kiln Volume (ft³) | 236 |

*Description*

Kiln: Carbon Steel Shell with Dual Refractory Lining (5-in Combustion Engineering Blue Ram[R] plus 2-in CE Lite Weight 58)

Exit Duct: Inconel 601

Burners: 1-Linde A[R] Oxygen Burner with Propane Pilot (8 MMBTU) 1-Maxon Fuel Oil Burner with Propanel Pilot (2.9 MMBTU/hr)




*Kiln Feed Rates*

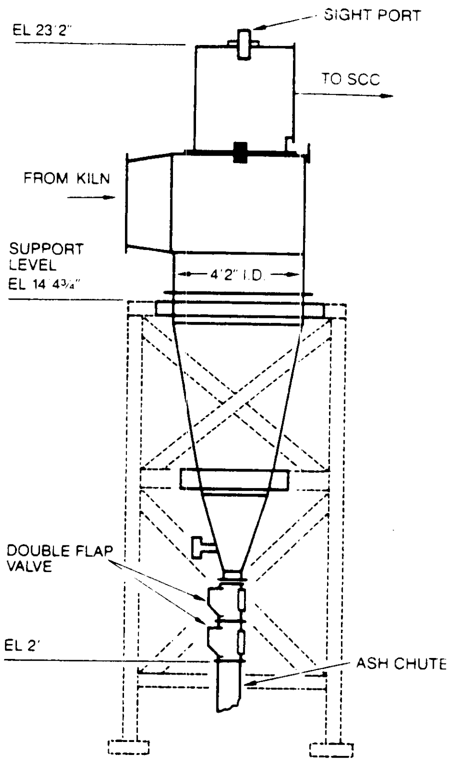
| | | |
|---|---|---|
| Air (SCFM) | 560 | |
| Oxygen (SCFM) | 118 | |
| Fuel Oil (gph) | 41 | |
| Waste Solids (lb/hr) | 4000 | (by permit) |
| Waste Liquids (lb/hr) | 150 | (by permit) |
| Water (gpm) | 1.5 | |

*Operating Conditions*

| | Normal | Maximum |
|---|---|---|
| Temperature (°F) | 1450 | 1900 |
| Pressure (in w.c.) | -0.3 | -1.0 |
| Flue Gas Residence Time | 3.0 | 5.0 |
| RPM | 1.0 | 2.0 |
| Solids Residence Time | 30 | 15 |
| Heat Release (MMBTU/hr) | 3.0 | 5.5 |

## *U.S. EPA Mobile Incineration System Facts and Figures*

*Cyclone*




*Dimensions*

| | |
|---|---|
| *Height (ft)* | 18 |
| *O.D. (in)* | 50 |
| *I.D. (in)* | 38 |
| *Volume (ft³)* | |

*Description*

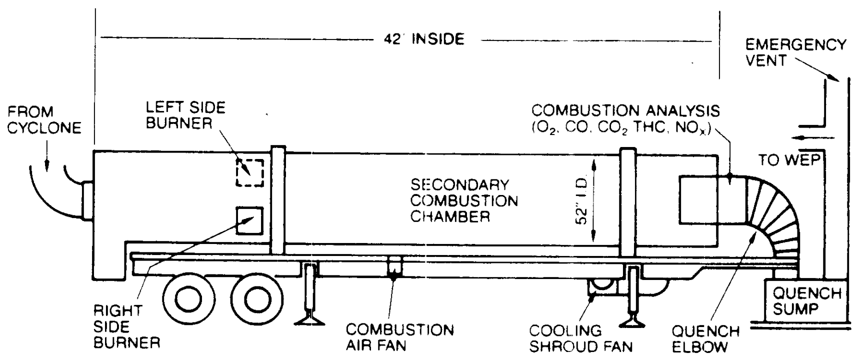
*Cyclone:* *Carbon Steel Casing with Dual Refractory Lining (3-in Insulating Resco RS-3 plus 3-in Resco RS-17E. Bottom Casing Inconel 601*

*Outlet Tube:* *Inconel 601*

*Operating Conditions*

| | *Normal* | *Maximum* |
|---|---|---|
| *Temperature (°F)* | 1450 | 1900 |
| *Pressure (in w.c.)* | -2.0 est. | -6.0 |
| *Flue Gas Residence Time (sec)* (includes ducts between kiln and SCC) | 1.5 | 2.4 |
| *Solids Residence Time (sec)* | 1.5 | 2.4 |
| *Cut Point (microns)* | 5.0 | |

*Secondary Combustion Chamber (SCC) and Quench*




*Dimensions*

| | |
|---|---|
| *Trailer Length (ft)* | 45 |
| *SCC Length (ft)* | 42 |
| *SCC I.D. (in)* | 52 |
| *SCC Volume (ft³)* | 531 |

*Description*

| | |
|---|---|
| *SCC:* | *Carbon Steel Shell with Forced Draft Cooling Annulus with Refractory Lining 6-in AP Green Kastolite 30* |
| *Quench Duct:* | *Inconel 625 with internal water spray (60 gpm)* |
| *Burners:* | *2-North American Burners with Propane Pilot (8.2 MMBTU/hr Total)* |

*SCC Feeds Rates*

| | |
|---|---|
| *Air (SCFM)* | 1200 |
| *Fuel Oil (gph)* | 41 |
| *Waste Liquids (lb/hr)* | none |

*Operating Conditions*

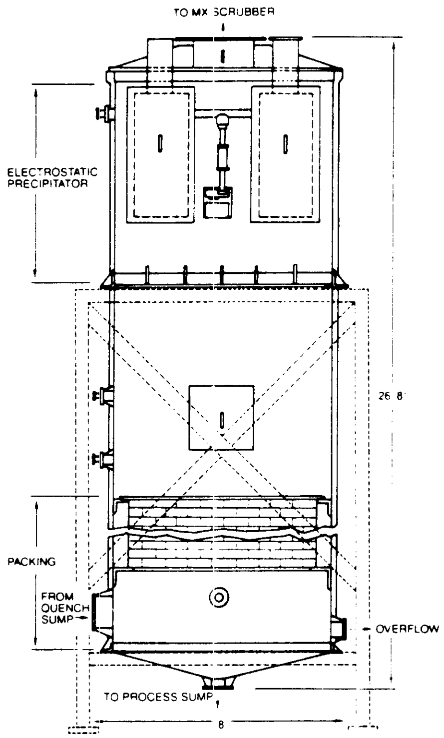
| | *Normal* | *Maximum* |
|---|---|---|
| *Temperature (°F)* | 2100 | 2400 |
| *Pressure (in w.c.)* | -3.0 | -10.0 |
| *Flue Gas Residence Time* | 2.5 | 2.0(min) |
| *Heat Release (MMBTU/hr)* | 5.4 | 8.2 |

*Flue Gas Composition from Trial Burn:*

| $O_2$ | $CO_2$ | $H_2O$ | $N_2$ | CO | $NO_x$ | HCl | $SO_2$ |
|---|---|---|---|---|---|---|---|
| 6.0% | 10.3% | 24.9% | 57.7% | 19 ppm | 96 ppm | 1.1% | <300 ppm |

## *U.S. EPA Mobile Incineration System Facts and Figures*

*Wet Electrostatic Precipitator (WEP)*



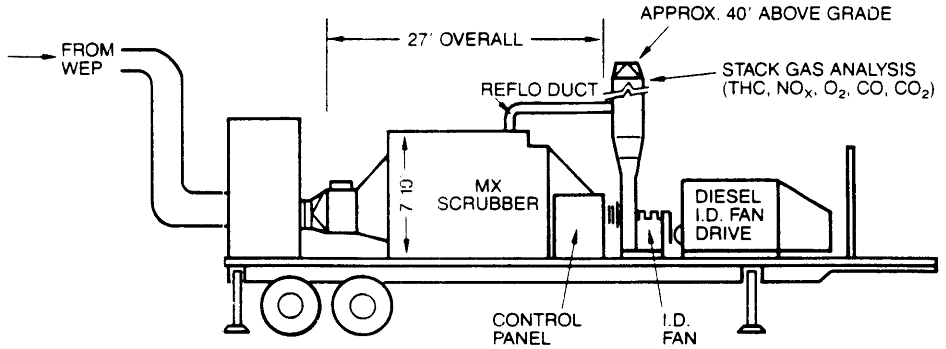

| *Dimensions* | | *Description* | |
|---|---|---|---|
| *Height (ft)* | 40 | *Housing:* | *Fiberglass-reinforced plastic (FRP) Hetron 97 with 5% Antimony Trioxide* |
| *Width (in)* | 84 | *Collector:* | *Conductive FRP* |
| *Length (in)* | 84 | *Rods:* | *304 Stainless Steel* |
| *Volume ($ft^3$)* | – | | |

*Operating Conditions*

| | *Normal* | *Maximum* |
|---|---|---|
| *Temperature (°F)* | 180 | 200 |
| *Pressure (in w.c.)* | -7.0 est. | -11.0 |
| *DC voltage (KV)* | 11 | 13 |
| *DC current (ma)* | 60 | 60 |
| *AC voltage (V)* | 140 | 140 |
| *AC current (a)* | 25 | 25 |
| *Fog Water (gpm)* | – | – |
| *Wash Water (gpm)* | – | – |

*Mass Transfer (MX) Scrubber and I.D. Fan*

| *Dimensions* | | *Description* | |
|---|---|---|---|
| *Trailer Length (ft)* | 45 | *Scrubber:* | *FRP filled with plastic packing plus a 304 Stainless Steel mist eliminator consisting of a three pass chevron unit and 5-in thick pad* |
| *Scrubber Length (ft)* | 8 | *I.D. Fan:* | *316L Stainless Steel housing with a Inconel 625 shaft and 36-in diameter impeller and 155 HP diesel engine* |
| *Scrubber Height (ft)* | 5 | *Stack:* | *2-ft x 2-ft 304 Stainless Steel, 40-ft high* |
| *Scrubber Volume ($ft^3$)* | 180 | | |




*MX Feed Rates*

| | |
|---|---|
| *Water: (gpm)* | 75 |

*Operating Conditions*

| | *Normal* | *Maximum* |
|---|---|---|
| *Temperature (°F)* | 175 | 200 |
| *Pressure (in w.c.)* | -12 | -19 |
| *HCl Removal Efficiency (%)* | >99.9 | |

*J.P. Stumbar, G.D. Gupta, R. Sawyer, A. Sherman, K.E. Hastings, J. DeHaan, G. King and M. Szynalski are with Foster Wheeler Enviresponse, Incorporated, Livingston, NJ 07039.*
***Joyce M. Perdek** is the EPA Project Officer (see below).*
*The complete report, entitled "EPA Mobile Incineration System Modifications, Testing and Operations – February 1986 to June 1989," (Order No. PB 90-260 449/AS; Cost: $31.00, subject to change) will be available only from:*

*National Technical Information Service*
*5285 Port Royal Road*
*Springfield, VA 22161*
*Telephone: 703-487-4650*

*The EPA Project Officer can be contacted at:*

*Risk Reduction Engineering Laboratory*
*U.S. Environmental Protection Agency*
*Edison, NJ 08837*

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