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Project Summary

Trial Burn Protocol Verification at a Hazardous Waste Incinerator

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Field tests were undertaken at the Cincinnati Metropolitan Sewer District (MSD) hazardous waste incinerator for the purpose of verifying the U.S. Environmental Protection Agency's (EPA's) trial burn protocol and to conduct an environmental assessment. The incinerator tested was equipped with a rotary kiln rated at 55 x 10^6 kJ/hr and a cyclone furnace rated at 65 x 10^6 kJ/hr. Air pollution control was provided by a venturi scrubber and sieve tray tower. Two types of waste were fired during the tests, one was a pesticide-containing waste and the second was a high chlorine content waste. Test results indicated that a 99.99% destruction and removal efficiency (DRE) was achieved, as required by the Resource Conservation and Recovery Act (RCRA) regulations for the selected principal organic hazardous compounds (POHCs). However, the incinerator did not meet the particulate standard of 180 mg/dscm nor the HCl removal efficiency of 99%. It is believed that the malfunction of the demister and the low pH of the absorber solution were the probable reasons for the higher particulate loading and the low HCl removal efficiency, respectively. Several recommendations have been made with respect to the trial burn protocol and the sampling and analysis procedures.

This Project Summary was developed by EPA's Industrial Environmental Research 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 EPA's Industrial Environmental Research Laboratory, Cincinnati, sponsored a program to evaluate the hazardous waste trial burn protocol and to conduct an environmental assessment of the Cincinnati MSD hazardous waste incinerator. Midwest Research Institute (MRI) carried out the program for EPA, as a subcontractor to Rockwell International Corporation.

This summary report presents a description of the MSD incinerator facility, a summary of the sampling and analysis program, a discussion of the test results, and recommendations of the study Complete descriptions and discussion of test results are contained in the project final report.

Description of the Facility

The Cincinnati MSD hazardous waste incinerator is located at 1600 Gest Street in Cincinnati. A schematic diagram of the incinerator is given in Figure 1. The symbols enclosed by circles in Figure 1 represent sampling points. As shown in the figure, the incinerator is equipped with a rotary kiln rated at 55 x 10^6 kJ/hr and a cyclone furnace rated at 65 x 10^6 kJ/hr. Liquid wastes were fired throughout the testing even though the kiln is designed to handle solid or semisolid wastes. The kiln and cyclone furnace are connected to a single combustion chamber that is 4.15 m (13.5 ft) diameter by 12 2 m (40 ft) high This chamber provides residence time for the

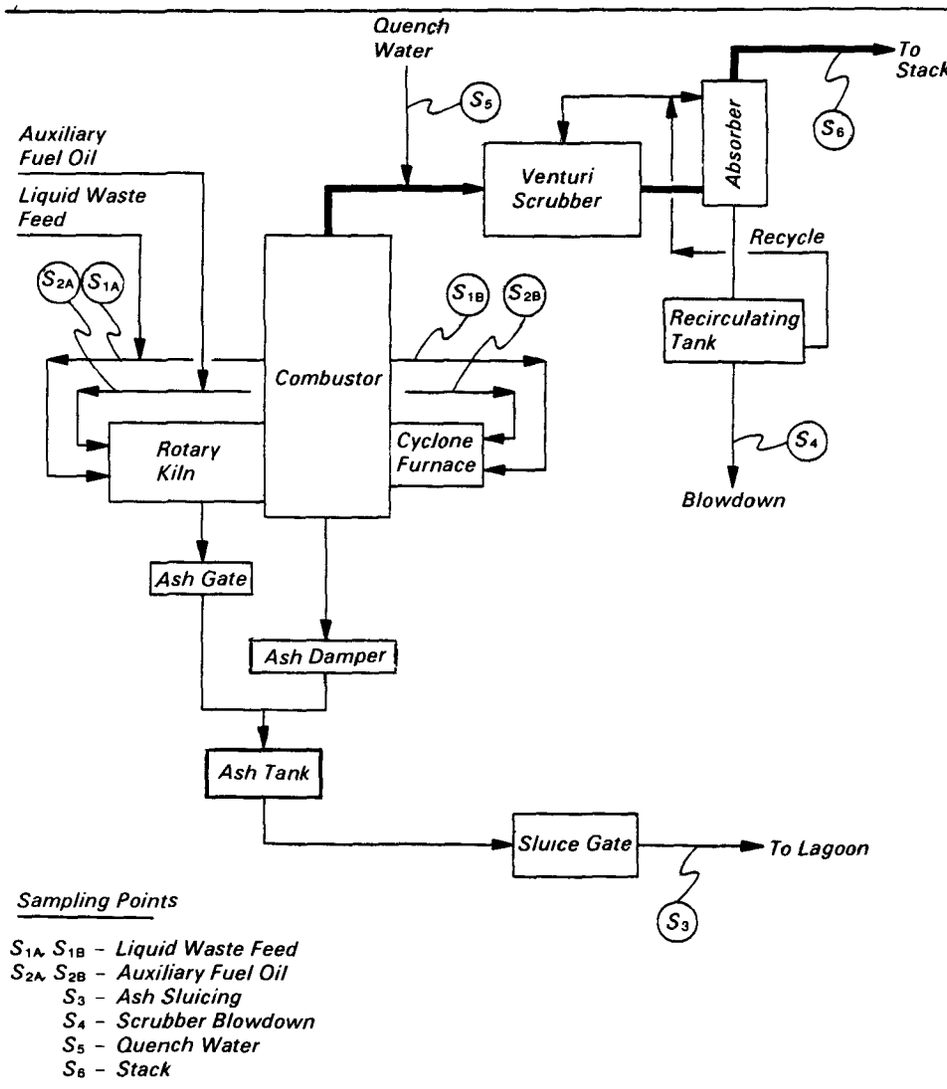

Figure 1. Schematic diagram of the Cincinnati MSD incinerator.

combustion gas and is normally maintained at 982°C (1800°F).

Gases exiting the combustion chamber are immediately quenched with water and pass into the venturi scrubber and then flow upward through the sieve tray scrubbing tower. Liquids fed to the venturi scrubber and sieve tray absorber should be maintained at 6.0 pH for HCl removal. A vane-type mist eliminator is located at the top of the absorber. Cooled gases from the absorber are exhausted through the induced draft fan into a stainless steel stack. Liquid effluent from the scrubbing system goes to the treatment plant, and bottom ash is sluiced with water out to a lagoon.

Sampling and Analysis Program

The sampling of the incinerator involved testing the incinerator with two different liquid wastes, one categorized as a pesticide-containing waste and the other as a high chlorine content waste. These two wastes were separately fired during two series of tests. The first series of incinerator tests was conducted at three different temperatures (899, 1093, and 1316°C) and two residence time ranges (1.5 to 2.2 sec and 3.3 to 3.7 sec), whereas the second test series was carried out at the same three temperatures but only at one residence time range (1.5 to 2.2 sec). These operating parameters (residence time and temperature) were varied to evaluate the effect of these parameters on POHC destruction and removal efficiency (DRE). A total of nine test runs, six during the first series and three during the second, were performed in this program.

Samples were taken, as shown in Figure 1, from the following process streams: feed waste, fuel oil, ash, scrubber effluent, quench water, an stack gases. Analysis of these sample was performed with the main objective of determining DRE for the six selecte POHCs, the particulate grain loading i the stack, the HCl removal efficiency, th emission levels of volatile trace metal CO, NOx, and hydrocarbons. Th sampling and analysis procedures use were either EPA methods or thos approved by the EPA Project Office According to the RCRA regulations o January 23, 1981, the incinerator i required to achieve 99 99% DRE fo POHCs, 99% HCl removal efficiency (fo waste containing more than 0 5° chlorine), and a particulate emission of n more than 180 mg/dscm (corrected t 12% CO_2). For each waste feed, si POHCs were selected and these are a follows·

Selected POHCs

First Waste

Chloroform
Carbon tetrachloride
Tetrachloroethylene
Hexachloroethane
Hexachlorobenzene
Hexachlorocyclopentadiene

Second Waste

Trichloroethane
Tetrachloroethane
Bromodichloromethane
Pentachloroethane
Hexachloroethane
Dichlorobenzene

Except for hexachlorobenzene and hexachlorocyclopentadiene, the selection of POHCs was based on the EPA ranking system, which takes into consideration the heat of combustion of the POHC and its concentration in the waste. With this ranking system, any POHC with a low heat of combustion is automatically assigned a high rank (difficult to incinerate), regardless of its concentration in the waste. Hexachlorobenzene and hexachlorocyclopentadiene, however, were selected as POHCs because they were present at high concentration levels and were of particular interest either to EPA or the MSD.

Test Results

Based on the testing effort, the DREs for the POHCs of interest, the HCl removal efficiency, the particulate concentration in the stack gas, and other results were obtained. These results are summarized in the full report. The

incinerator achieved 99.99% DRE for the selected POHCs with the exception of bromodichloromethane at an operating temperature of 899°C (1650°F). The particulate standard of 180 mg/dscm was not achieved, probably because of the demister malfunction. The required HCl removal efficiency of 99% was also not achieved; this could be due to the low pH of the scrubber solution and some uncertainties associated with the sampling and analysis method for HCl. The concentrations of POHCs in the scrubber effluent and bottom ash were below detection limits in all runs but one.

Conclusions/ Recommendations

The test burn and environmental assessment were successfully completed. By and large, the trial burn protocol was found to be workable. However, since a major objective of the program was to evaluate the trial burn protocol, identify problems, and suggest recommendations, the following recommendations are being made.

- The acquisition and storage of a sufficient quantity of waste to enable testing throughout a trial burn test period could pose difficulties. One option for overcoming this problem would be to direct trial burns to wastes containing POHCs that are more difficult to incinerate, and allowing wastes with POHCs that are less difficult to incinerate to be burned without a trial burn. Also one could limit the duration of a trial burn to a 2-hr period in order to conserve waste. The key consideration however, would be to ensure that the POHCs of interest are in sufficient concentrations in the waste to enable detection at the stack after they have undergone 99.99% destruction. Our experience indicates that a minimum concentration of 100 ppm in the waste would enable detection in the stack if sampled over a 2-hr period.

- A trial burn must consist of three replicate tests.

- The sampling protocol for the incinerator waste feed, scrubber effluent, and bottom ash should be clarified to explain how such samples should be taken. It is recommended that, whenever possible, an integrated sample be taken for liquid waste feeds consisting of taking subsamples at 15-min intervals. For scrubber effluent and bottom ash, grab samples should be adequate.

- Selection procedures for POHCs need to be clarified. In its present form, the protocol relies on the EPA ranking system, which emphasizes the heat of combustion and minimizes the importance of concentration. However, concentration becomes an important factor if one is interested in identifying products of incomplete combustion

- A sampling technique needs to be developed for volatile POHCs.

- Metals analysis in the waste feed samples could pose a problem since the semisolid phase present in some of the samples could not be effectively digested. EPA is presently developing better digestion methods.

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***Donald A. Oberacker** is the EPA Project Officer (see below).*
The complete report, entitled "Trial Burn Protocol Verification at a Hazardous Waste Incinerator," (Order No. PB 84-159 193; Cost: $22.00, subject to change) will be available only from:
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