United States
Environmental Protection
Agency

Hazardous Waste Engineering
Research Laboratory
Cincinnati OH 45268

Research and Development

EPA/600/S2-85/122 Jan. 1986

EPA

Project Summary

Evaluation of Pilot-Scale Air Pollution Control Devices on a Municipal Waterwall Incinerator

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Field tests were conducted at a 120 ton/day, moving grate, waterwall incinerator to evaluate the capabilities of a pilot fabric filter and pilot venturi scrubber in controlling particulate, trace element, and gaseous air pollutants from a waste-as-fuel process. The Braintree, Massachusetts Municipal Solid Waste Incinerator mass burns unprocessed solid waste in a waterwall incinerator with steam generation. Both the pilot fabric filter and a pilot scrubber were installed, operated, and tested as primary control devices upstream of the existing full-scale ESP.

This Project Summary was developed by EPA's Hazardous Waste Engineering 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

This study was undertaken to evaluate prototype air pollution control devices on various waste-as-fuel processes for the control of potentially harmful air emissions. Several types of pollutants have been identified in air emissions from various resource recovery operations; these include particulates, metals, chlorides, sulfur oxides (SO_x), nitrogen oxides (NO_x), and polycyclic organic materials (POMs).

A literature review of state-of-the-art technologies (e.g., fabric filter, ESP, and scrubber) for control of waste-as-fuel processes revealed that fabric filters have been successfully applied to preprocessing operations, and ESPs are the most common air pollution control equipment used on cofired boilers and mass-burn incinerators. Full-scale fabric filters have not been applied to waste-as-fuel combustion processes, and wet scrubbers have been used on incinerators with less success than ESPs.

The Braintree, Massachusetts incinerator was selected for this study because of the cooperation of the management, availability of data from a previous Midwest Research Institute source assessment project, high reliability of the incinerator operations, and limited facility modifications required.

Braintree Test Plans and Results

The Braintree Municipal Incinerator No. 1, shown in Figure 1, was built in 1971 by Riley Stoker. It is designed to generate 14,000 kg/h (30,000 lb/h) of steam at 1723 kPa (250 psi) and 208°C (406°F). A specially built pilot fabric filter was tested along with a pilot scrubber provided by Neptune-Airpol. Both units slipstreamed flue gas ahead of the existing full-scale ESP, and, were operated over consecutive time periods.

The incinerator was operated dependably throughout the entire test period, firing about 4.5 Mg/h (5 tons/h). Normal "steady-state" operating conditions were maintained, with no attempt to optimize the system.

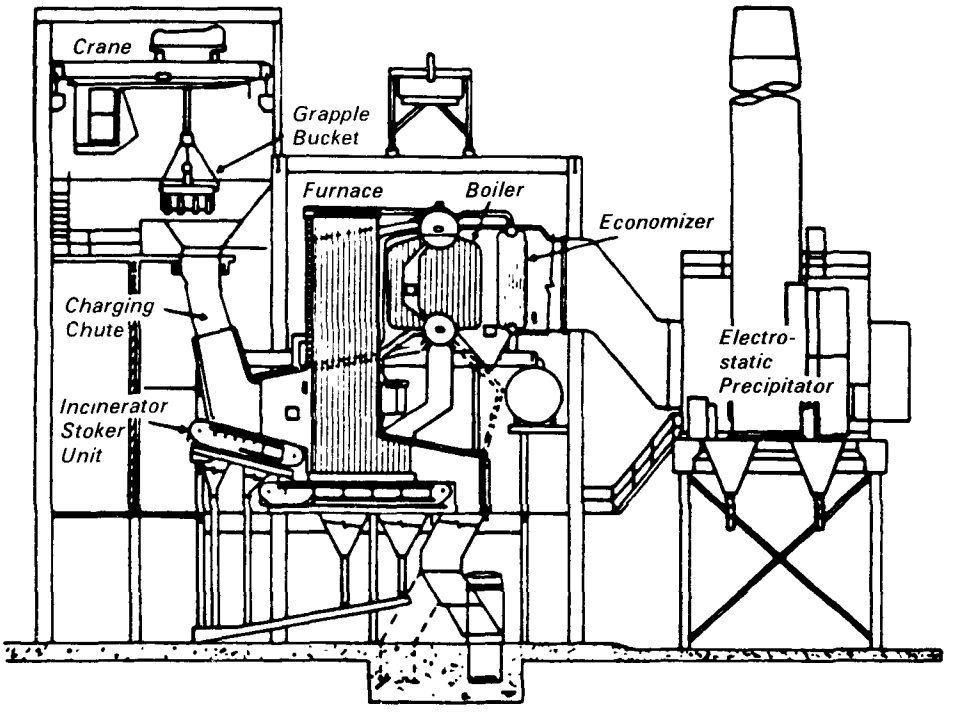


Figure 1. *Braintree municipal incinerator, Braintree, Massachusetts.*

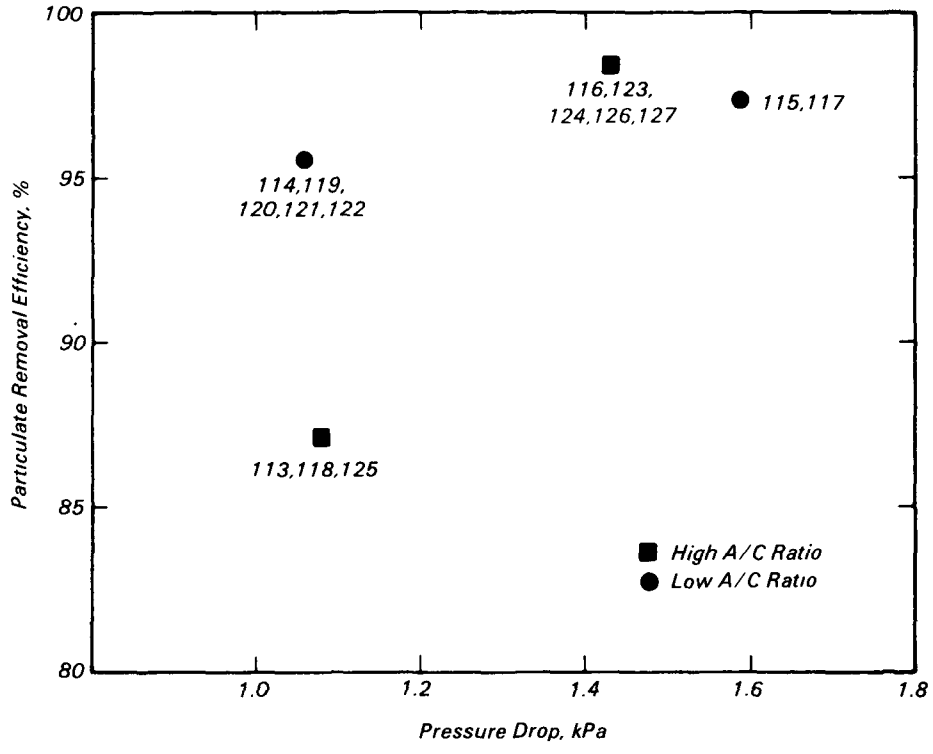
The fabric filter was operated at an air-to-cloth (A/C) range of 0.46 m^3/min per m^2 to 0.91 m^3/min per m^2 (1.5 to 3.0 acfm per ft^2). The unit was equipped with reverse air, mechanical shake, or a combination of the two for cleaning the fabric. Figure 2 shows particulate removal efficiency as a function of pressure drop and (A/C) ratios. For a specific A/C ratio particulate removal efficiency seems to increase with increasing pressure drop. The effect of A/C on particulate removal capabilities, within the A/C range tested, is unclear. The fabric filter was precoated with hydrated lime over the entire test period, in an attempt to improve gaseous pollutant removal. Chloride and SO_x removal efficiencies improved and roughly doubled (approximately 28 percent and 37 percent removal for chloride and SO_x, respectively) over the results of an earlier test series at Ames, where no precoat additive was used.

The pilot scrubber used at Braintree was less effective than expected in controlling particulates. One cause may be poor mist elimination in the separator section of the unit. Figure 3 presents the particulate removal efficiencies as a function of venturi pressure drop and liquid-to-gas (L/G) ratio. It appears from the graph that at low L/G ratios, increasing pressure drop improves collection efficiency. At high L/G ratios, an increase in collection efficiency with increasing pressure drop is not apparent. The removal of chloride with the venturi scrubber was highly effective (94 to 99 percent).

Conclusions

At Braintree, the fabric filter operated at a slightly lower than expected efficiency for particulate removal; however, when the fabric was precoated with lime, SO_x and chloride removal capabilities doubled compared with tests without precoating performed in an earlier test series at Ames. Particulate and metal removal efficiencies for the scrubber were much lower than for the fabric filter, but gaseous chlorides were removed with 96.5 percent efficiency (by the scrubber).

In summary, conventional state-of-the-art air pollution control devices were found to be effective in controlling the pollutants investigated: particulate, trace metals, SO_x, and halides. The fabric filter was more efficient in controlling particulate emissions than gaseous pollutants. A venturi scrubber was very effective in removing gaseous pollutants. Varying specific operating parameters can optimize pollutant removal efficiencies.



igure 2. *Particulate removal efficiency of pilot fabric filter as a function of pressure drop.*

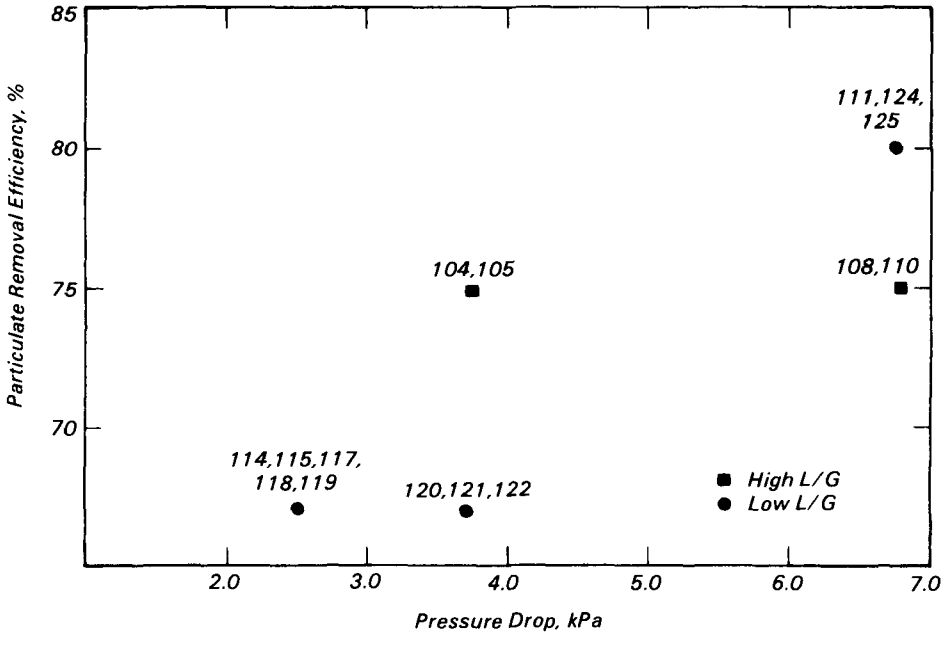


Figure 3. *Particulate removal efficiency of pilot scrubber as a function of pressure drop.*

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***Robert A. Olexsey** and **Michael Black** are the EPA Project Officers (see below).*
The complete report, entitled "Evaluation of Pilot-Scale Air Pollution Control Devices on a Municipal Waterwall Incinerator," (Order No. PB 86-113 792/AS; Cost: $11.95, subject to change) will be available only from:
National Technical Information Service
5285 Port Royal Road
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Telephone: 703-487-4650
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