



Project Summary

Demonstration Test of Refuse-Derived Fuel as a Supplemental Fuel in Cement Kilns

Cliff R. Willey and Carl S. Weinberger

Air emission tests consisted of three sampling runs with coal only and three runs with coal and Refuse Derived Fuel (RDF). Sampling was done at the stack following gas cleanup by electrostatic precipitators. Analysis was done for particulates (EPA Method 5), SO_x (Method 6), chlorides (as HCl) and NO_x. A precipitator malfunction and cleanout occurred just prior to the tests.

Particulates averaged 0.022 gr/dscf burning coal and 0.059 gr/dscf burning coal and RDF. Chlorides increased slightly; NO_x was not significantly affected. SO_x results appeared to be affected by the precipitator cleanout. Dust buildup in the ESPs was noted when burning RDF, indicating that some adjustment to the precipitators may be needed when using RDF to achieve maximum particulate cleanup of the gas stream.

The full report also discusses RDF preparation equipment and RDF feed equipment developed for the tests.

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

The cement manufacturing industry represents an attractive opportunity to recover energy from municipal solid waste. It consumes significant amounts of energy, 457 trillion Btu per year, and includes 49 plants with capacities to use

over 380 tons per day of refuse derived fuel. The industry also involves a process in which ash and other products of combustion become part of the manufactured product, thus minimizing the requirement for ash disposal and reducing the need for costly additional air pollution control equipment.

In spite of this attractiveness, progress towards the use of RDF in the cement industry has been slow, tempered by industry caution on one hand and a lack of test information on the other. None of the tests in the United States has involved more than 5 test days.

In 1975, when discussions were begun with the Lehigh Portland Cement Company regarding potential use of refuse derived fuel in the production of cement, it became apparent that even though there was interest, there also was concern about the untried nature of the fuel. This concern included:

- ability to supply and feed RDF continuously,
- firing characteristics and ability to burn RDF in suspension,
- effect on RDF chemical composition and variations in composition on cement quality and chemistry,
- long-term effects on RDF on kiln operation and cement production, and
- effect on air emissions.

The following test program was developed to address these concerns:

1. RDF would first be tested at a coal-fired, lightweight shale kiln. The advantage of such testing was the experience gained with the burning characteristics of RDF and with the

reliability of RDF feed equipment. As part of the test agreement, the feed equipment was expected to demonstrate 7 days of continuous operation before tests could begin at the cement plant.

2. When the lightweight aggregate test was satisfactorily demonstrated, RDF feed equipment would be set up at a cement plant to produce test quantities of cement for analysis (2 to 3 day test).
3. Again, based on satisfaction with the production step, an extended burn test involving air emission measurements would be run.

Conclusions

- Satisfactory Type I and Type II cement were produced burning supplemental refuse derived fuel with coal. Physical properties such as strength and set time were within acceptable limits. Chemical composition of cement produced with RDF and coal was not significantly different from cement produced with only coal. No alteration of the infeed raw material mix was needed to adjust for differences in chemical makeup caused by substitution of RDF for coal. These results apply to the test conditions in which up to 37 percent of the heat was supplied by RDF.
- Fluff RDF (as well as the primary fuel) must burn in suspension to avoid causing low oxygen (reducing) condition at the kiln bed and subsequent unacceptable changes in cement chemistry. For the conditions of this test, RDF would require secondary shredding to a size 95 percent less than 2.5 cm (1 in.) for suspension burning. More or less finely shredded

RDF may be required for different kiln conditions, feed techniques, and feed rates.

- Although stack emission tests were probably affected by a precipitator outage and cleaning prior to the test period and must be interpreted with caution, none of the emissions tested—particulates, chlorides, nitrous oxides, and sulfur oxides—appeared to present a serious problem. Ash buildup in the ESP with time after starting to burn RDF indicated RDF may have affected the properties of the dust-fly ash mix collected by the ESPs and that some adjustment in operating conditions might be required if RDF were burned on a continuous basis.

- Fluff RDF can be stored in transfer trailers and reliably fed from the trailers provided: (a) the RDF is only moderately compacted in the trailers; (b) lump breakers or some other means is used to re-fluff and even out the flow of RDF; and (c) the rate of trailer unloading and the speed of the feed conveyors are controllable.

Recommendations

Long-term tests of RDF as a cement kiln fuel should be continued to establish industry confidence in the use of this fuel. The best approach may be the development of a semi-automated feed station for continuous RDF fuel use at a cement manufacturing plant.

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The complete report, entitled "Demonstration Test of Refuse-Derived Fuel as a Supplemental Fuel in Cement Kilns." (Order No. PB 85-180 842/AS; Cost: \$10.00, subject to change) will be available only from:

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☆ U.S. GOVERNMENT PRINTING OFFICE: 1985-559-016/27058

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