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Project Summary

Proceedings: EPA's Industry Briefing on the Adipic Acid Enhanced Limestone FGD Process (July 1981)

J. David Mobley, Briefing Chairman

The proceedings document presentations made during an EPA-sponsored industry briefing which was held on July 15, 1981, in Springfield, MO. The briefing dealt with the status of EPA's research activities on the adipic acid enhanced limestone flue gas desulfurization (FGD) process. Subjects covered included: (1) overview of the adipic acid enhanced process, (2) status of the demonstration project at Springfield City Utilities, (3) results of the demonstration project on an industrial boiler, (4) results of testing at the EPA prototype test facility at TVA's Shawnee Steam Plant, and (5) economics of limestone FGD systems using adipic acid. The briefing provided users, architects, engineers, vendors, consultants, and government personnel with a comprehensive assessment of this innovative technology for controlling SO_2 emissions.

This Project Summary was developed by EPA's Industrial Environmental Research Laboratory, Research Triangle Park, NC, 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

EPA's Industrial Environmental Research Laboratory in Research Triangle Park (IERL-RTP) periodically sponsors symposia and industry briefings for the transfer of information regarding research, development, and application activities with the objective of further accelerating the development and commercialization of technology. One of the major IERL-RTP efforts for the past several years has been advancement of the technology for flue gas desulfurization (FGD). A key element of the FGD program has been the advancement of lime/limestone wet scrubbing technology, which has led to the development of the adipic acid enhanced limestone FGD process.

The July 15, 1981, industry briefing provided interested people with EPA's latest findings on the use of adipic acid in lime/limestone scrubbers. The presentations covered testing work performed at the laboratory, bench, pilot, prototype, industrial, and utility scales. In addition, an economic assessment of the use of the technology on new and retrofit systems was included. The presentations were complemented by a tour of the limestone FGD system at Springfield City Utilities' Southwest Power Station in Springfield, MO.

During the tour the FGD system was operating with the addition of approximately 1500 ppm of adipic acid. The scrubber was operating at 5.5 pH with a liquid-to-gas ratio of about 60 gal./1000 ft^3.* The boiler was operating at 75% of

*Readers more familiar with the metric system may use the following conversion factors: 1 Btu = 1.055 J, 1 ft^3 = 0.028 m^3, 1 gal = 3.79 liters, and 1 lb = 0.45 kg.

maximum load with uncontrolled emissions of 6.5 lb/10^6 Btu. The emissions after the scrubber were 0.3 lb/10^6Btu which represents an SO_2 removal efficiency of over 95%. The SO_2 removal efficiency of the unit under similar operating conditions but without the adipic acid additive had been about 70%.

More than 120 people (representing electric utilities, industrial sources, architect and engineering firms, vendors, consultants, and government personnel) attended the briefing in Springfield, MO.

Abstracts of the presentations follow. Asterisks by authors' names denote presenters.

Overview of EPA's Testing of the Adipic Acid Enhanced Limestone FGD Process

John C. S. Chang, Acurex Corporation and J. David Mobley,* U.S. Environmental Protection Agency

Extensive research has determined that adipic acid, when used as an additive to a limestone flue gas desulfurization (FGD) system, will improve the performance of the system. Both SO_2 removal and limestone utilization can be greatly increased by the buffering effect of adipic acid. Extensive test data show that the technology is ready for full scale application. Although adipic acid does degrade in the scrubber, no significant operating problems or environmental impacts have been identified. Economic estimates show the adipic acid enhanced limestone FGD system to be economically attractive, compared to conventional FGD systems. In addition, further research is underway to decrease the cost of using additives in FGD systems.

Status of Adipic Acid Enhanced FGD System Demonstration at Springfield City Utilities Southwest Power Plant

O. W. Hargrove*, J. D. Colley, and G. E. Brown, Radian Corporation

Adipic acid, as an additive to enhance the performance of limestone FGD systems, was demonstrated quite successfully at Springfield City Utilities' Southwest Power Plant (SWPP), a 194-MW coal-fired unit designed to burn 3.5-4.0% sulfur coal. Both forced and natural oxidation testing were planned at Springfield. The forced oxidation tests were completed in late April 1981; the natural oxidation tests should be completed in August 1981. SO_2 removal efficiencies greater than 90% were consistently achieved for over 35 days with adipic acid in the forced oxidation mode. This compares with SO_2 removal efficiencies of 50-60% without adipic acid. Limestone utilization was also typically about 90%. In addition, the scrubber operated for 36 days with only about 10 hours of downtime. This represents the longest period of continuous operation at SWPP to date. The improved reliability can be attributed to design modifications and operating procedure changes implemented by City Utilities, additional process input by Radian, and process reliability factors created by adipic acid addition and forced oxidation.

Evaluation of the Adipic Acid Enhanced Limestone Flue Gas Desulfurization Process on an Industrial Boiler

R. W. Gerstle and D. S. Henzel PEDCo Environmental, Inc. and J. David Mobley* U.S. Environmental Protection Agency

The purpose of this study was to evaluate the effect of the addition of adipic acid on the SO_2 removal of a wet limestone FGD system on a coal-fired industrial boiler facility. The boiler facility at the Rickenbacker Air National Guard Base near Columbus, OH, was selected for this study. Emission data were collected in accordance with the regulations for SO_2 compliance data specified in the *Federal Register.* Test results show that adding adipic acid to the limestone slurry significantly improved the SO_2 removal efficiency of the FGD system. Limited baseline data on operations with limestone only indicated a performance level of 55% SO_2 removal. With addition of about 2200 ppm of adipic acid to the limestone scrubbing system, the unit's level of performance increased to an average of 94.3% SO_2 removal over a 30-day test period.

Adipic Acid-Enhanced Lime/Limestone Test Results at the EPA Alkali Scrubbing Test Facility

Shih-Chung Wang and Dewey A. Burbank* Bechtel National, Inc.

FGD tests are being conducted at EPA's 10-MW prototype test facility at TVA's coal-fired Shawnee Power Station near Paducah, KY. Test results show that adipic acid is a powerful lime and limestone scrubber additive for improving SO_2 removal. SO_2 removal efficiencies in excess of 90% and reliable scrubber operation have been demonstrated in four long-term (greater than 1 month) limestone runs with adipic acid enhancement: two venturi/spray tower runs using two scrubber loops with forced oxidation in the venturi loop, a TCA run without forced oxidation, and a spray tower run with forced oxidation. Full or partial factorial tests, each lasting 12 hours or longer, including 5-7 hours of steady-state operation, were also conducted to characterize the SO_2 removal performance of the scrubber as a function of operating parameters such as gas and slurry flow rate, pH, and adipic acid concentration. Data from these tests were correlated using a semi-theoretical mathematical model that conforms to boundary constraints to provide a design basis for use of adipic acid in lime/limestone scrubbers.

Economics of Limestone FGD Systems Using Adipic Acid

R. L. Torstrick*, C. D. Stephenson, J. D. Veitch Tennessee Valley Authority

The economics of the use of adipic acid additive in limestone FGD were examined using current design and economic premises established for the continuing series of economic evaluations performed by TVA for EPA. Economics were projected based on long-term Shawnee test facility operating data, Springfield test facility operating conditions, and recent Shawnee test facility operation. Incorporating the improved scrubbing efficiency effected by adipic acid into the design of a 90% SO_2 removal limestone FGD-landfill process reduces the capital investment and annual revenue requirements by about 2% each. A further similar

reduction is attained using 95% removal and partial bypass. For existing facilities, based on Springfield and Shawnee data, using adipic acid increases capital investment and annual revenue requirements slightly but reduces the unit cost in terms of cost per ton of SO_2 removed. Although the differences in economics are not significant, considering the accuracy of these cost projections, the use of adipic acid for obtaining higher degrees of SO_2 removal may be significant in (1) bringing marginal plants into compliance, and (2) allowing power units to burn higher sulfur coals to reduce costs. One of the more significant advantages of using adipic acid is the ability to improve the SO_2 removal efficiency of an existing scrubber system simply by adding adipic acid.

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The complete report, entitled "Proceedings: EPA's Industry Briefing on the Adipic Acid Enhanced Limestone FGD Process (July 1981)," (Order No. PB 82-231 853; Cost: $13.50, subject to change) will be available only from:

National Technical Information Service
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