United States
Environmental Protection
Agency

Air and Energy Engineering
Research Laboratory
Research Triangle Park NC 27711

Research and Development

EPA/600/S9-85/009 May 1985

EPA

Project Summary

Proceedings: EPA's Industry Briefing on the Organic-Acid-Enhanced Limestone FGD Process (July 1984)

J. David Mobley

The proceedings document presentations made during an EPA-sponsored industry briefing, July 19, 1984, in San Antonio, TX. The briefing dealt with the status of EPA's research activities on the organic-acid-enhanced limestone flue gas desulfurization (FGD) process. Subjects covered included: (1) a technical and economic evaluation of organic acid addition to the San Miguel FGD system—results of parametric tests and the utility's perspective, (2) results of the first 2 years of commercial operation of an organic-acid-enhanced FGD system, (3) economics of retrofitting Big Rivers Electric Corporation's lime-based FGD system to organic-acid-enhanced limestone operations, and (4) an economic evaluation of limestone and lime FGD processes for new systems. 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 Air and Energy Engineering 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 Air and Energy Engineering Research Laboratory (AEERL)* 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 AEERL 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 organic-acid-enhanced limestone FGD process.

The July 19, 1984, Industry Briefing was designed to provide interested people with EPA's latest findings on the use of organic 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 FGD system at San Miguel Electric Cooperative's Jourdanton Station in Jourdanton, TX; a summary of the tour is provided as an appendix to the proceedings.

*Formerly EPA's Industrial Environmental Research Laboratory, Research Triangle Park, NC.

More than 220 people representing electric utilities, industrial sources, architect and engineering firms, vendors, consultants, and governmental personnel attended the briefing in San Antonio, TX.

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

Technical and Economic Evaluation of Organic Acid Addition to the San Miguel FGD System—Part 1—Results of Parametric Tests

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Radian Corporation

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This paper summarizes the results of organic acid addition tests at a commercial FGD system. The tests were conducted at San Miguel Electric Cooperative's 410 MW lignite-fired Unit 1, outside Jourdanton, TX. During the program, several organic acid mixtures were tested over a range of operating conditions. The objective of these tests was to determine if the use of organic acids would allow San Miguel to reduce FGD system operating costs. Based on the test results, a cost analysis indicated that the use of organic acid addition at San Miguel will result in a first-year cost savings of over $600,000. In terms of cumulative net present worth, the estimated savings over a 15-year period will be $7.2 million 1984 dollars.

Technical and Economic Evaluation of Organic Acid Addition to the San Miguel FGD System—Part 2—The Utility's Perspective

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San Miguel Electric Cooperative's FGD system started up in 1981 and immediately became an area of operating problems for the utility. After fighting major problems for over a year, San Miguel participated in an EPA-sponsored study to explore the costs and benefits of an organic acid conversion to improve the performance of their limestone based FGD unit. Based on the results of the initial study, San Miguel agreed to participate with the EPA in a test program to gather actual data on the conversion of a large commercial unit to organic-acid-enhanced operations. Benefits include:

- Improved process operation and substantial cost savings were estimated to be $7.2 million over a 15-year period. Current operating experiences indicate that this figure is low. To ensure that these savings are real, San Miguel will continue to develop and refine its operating skills.
- Reduced limestone stoichiometry, accomplished by reducing the operating pH, has resulted in better limestone utilization and slurry oxidation.
- Reduced scaling and pluggage in scrubber modules has increased efficiency with less maintenance.
- Reduced scrubber waste production requires less operation time for the system and less truck hauling time back to the mine.

Results of the First 2 Years of Commercial Operation of an Organic-Acid-Enhanced FGD System

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The U.S. EPA has sponsored research to develop organic-acid-enhanced flue gas desulfurization (FGD) technology for existing and new coal burning facilities. A 1981 EPA-sponsored demonstration program at Springfield City Utilities' Southwest Power Plant (SWPP), near Springfield, MO, showed that adipic acid and dibasic acid (DBA) greatly enhanced FGD performance. SWPP has continued to use DBA to comply with the 1971 SO_2 emissions standard under which they are regulated. Thus, SWPP became the first commercial-scale system to use an organic additive to enhance SO_2 removal. This paper documents the first 2 years (1982 and 1983) of commercial operation of the DBA system at SWPP. During 1982 and 1983, SWPP averaged an SO_2 emission rate of less than 1.0 lb $SO_2/10^6$ Btu (430 ng/J). Conversely, in 1980 (prior to DBA addition), SWPP averaged about 5 lb $SO_2/10^6$ Btu (2,170 ng/J). FGD system reliability has also greatly improved, averaging 97.9 percent in 1982 and 98.7 percent in 1983, compared to 45 percent in 1980. Overall, DBA has increased the flexibility of the SWPP system and, most importantly, allowed SWPP to operate in compliance.

Economics of Retrofitting Big Rivers Electric Corporation's Lime Based FGD System to Organic-Acid-Enhanced Limestone Operations

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In 1982-83, Peabody Process Systems, Inc. (PPSI) conducted pilot plant tests at the R. D. Green Station of Big Rivers Electric Corporation (BREC). PPSI's final report of the pilot testing included comparisons of the operating costs of a lime based, full-sized absorber, to a retrofit limestone system enhanced with dibasic acid (DBA) or adipic acid. The site specific changes required for BREC to convert their existing lime FGD system to a limestone system enhanced by DBA or adipic acid, and the costs of making such a change, are described in this paper. Results of this analysis indicated that an annual cost savings of $2.6 million could be achieved by converting the existing lime system to an adipic-acid-enhanced limestone system, and an annual savings of $3.1 million could be achieved by converting to a DBA-enhanced system.

Economic Evaluation of Limestone and Lime Flue Gas Desulfurization Processes for New Systems

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The preliminary-grade economics (accuracy: -15 percent, +30 percent) of various alternative limestone and lime flue gas desulfurization (FGD) processes are examined using the current design and economic premises established for the continuing series of economic evaluations performed by TVA for EPA. The economics are projected using the Shawnee lime/limestone computer model, which is based on long-term operating data from EPA's alkali scrubbing test facility at TVA's Shawnee Steam Plant near Paducah, KY. The capital investment for the base-case limestone scrubbing process (500 MW, 3.5 percent sulfur coal, 1979 NSPS, spray tower, forced oxidation, landfill) is $206/kW. The first-year and levelized annual revenue requirements are 10.59 and 15.09 mills/kWh, respectively. Costs for the equivalent limestone scrubbing process using a Turbulent Contact Absorber (TCA) are lower, while those for the venturi/spray tower absorber are higher. Forced-oxidation/landfill disposal has a lower capital investment than unoxidized/pond disposal for all options studied; however, the first-year and levelized annual revenue requirements are slightly higher for the forced-oxidation/landfill process for most coal applications. For the spray tower limestone process to achieve a specified SO_2 removal efficiency, it is more economical to increase the limestone stoichiometry and minimize the absorber liquid/gas ratio (L/G). The use of adipic acid or possibly dibasic acid (DBA) as an additive to enhance SO_2 removal in the limestone scrubbing process is an economically attractive option.

*The EPA author, **J. David Mobley** (also the EPA Project Officer, see below), is with Air and Energy Engineering Research Laboratory, Research Triangle Park, NC 27711.*

The complete report, entitled "Proceedings: EPA's Industry Briefing on the Organic-Acid-Enhanced Limestone FGD Process—July 1984," (Order No. PB 85-181 105/AS; Cost: $16.00, subject to change) will be available only from:

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
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☆ U.S. GOVERNMENT PRINTING OFFICE: 1985—559-016/27046