United States
Environmental Protection
Agency

Air and Energy Engineering
Research Laboratory
Research Triangle Park 27711

Research and Development

EPA/600/S9-91/015 July 1991

EPA

Project Summary

Proceedings: 1990 SO_2 Control Symposium

Charles B. Sedman

This report compiles 110 presented papers from the 1990 SO_2 Control Symposium held in New Orleans, LA, May 8-11, 1990. Topics include: SO_2 control economics, furnace sorbent injection, byproduct utilization, spray dryer technology, wet flue gas desulfurization (FGD) and combined SO_x/NO_x control technologies, and post-combustion dry sorbent injection. Many papers present results from full-scale operational studies, while laboratory and pilot-scale research on new technologies is also emphasized.

This Project Summary was developed by EPA's Air and Energy Engineering Research Laboratory, Research Triangle Park, NC, to highlight key topics of interest on SO_2 control that are fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

The Symposium, jointly sponsored by the Electric Power Research Institute (EPRI) and the Air and Energy Engineering Research Laboratory, U.S. Environmental Protection Agency (AEERL/USEPA) is held periodically to transfer technical information and advance technology development and application for control of SO_2 emissions from fuel combustion. The 1990 SO_2 Control Symposium was held in New Orleans, LA, May 8-11, 1990. The proceedings from this Symposium consist of four volumes, containing 110 presented papers covering 14 technical sessions:

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1	International Overview
2	Economics
3A	Furnace Sorbent Injection (FSI)
3B	Byproduct Utilization
4A	FSI Recycle
4B	Wet FGD Reliability
4C	Spray Dryers
5	Wet Full Scale Operation
6A	Emerging Technologies
6B	Combined SO_x/NO_x Technologies
6C	Wet FGD Vendor Designs
7A	Post-Combustion Dry Technologies
7B	Wet FGD Research
Poster Session	Misc. FGD Topics

International Developments

Four papers on international SO_2 control at electric generating stations were presented covering Japan, Canada, the United Kingdom, and Europe. Flue gas desulfurization (FGD) technology in Japan dated to 1973. Currently wet FGD has evolved with a fourth generation system using limestone, a single oxidation and absorption tower, and generating a gypsum byproduct. A combined SO_x/NO_x system using activated coal char as the sorbent is scheduled for demonstration in 1990-91. Fluidized bed combustion is also used in Japan but is not widespread. The author concludes that future systems of choice will be the dry bed, combined SO_x/NO_x removal system using char sorbent.

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Canada currently has no commercial add-on SO_2 control technologies in place, but has considerable developmental activities ongoing. Individual utility companies have initiated research programs to comply with provincial SO_2 reduction goals by the mid 1990s. The individual research programs for Nova Scotia Power, New Brunswick Electric Power Commission, Ontario Hydro (Saskatchewan) Power Corporation, and Alberta Power Limited were discussed. A full array of technologies, many of which are detailed later in this Symposium, were cited as candidates for research and/or evaluation.

The United Kingdom has 70,000 MW_e of electrical generating capacity, the majority being coal-fired. Recent legislation targets 40% SO_2 reduction by 1998 and 60% reduction by 2003, which will result in considerable retrofit of existing facilities.

The West German retrofit program (GFAVO) was enacted in 1983 and has resulted in 150 units, over 30,000 MW_e capacity, retrofitted with FGD, along with 7400 MW of new capacity. Wet limestone, forced-oxidation scrubbers have accounted for 90% of FGD installations.

FGD Economics

The Economics Session emphasized the anticipated costs of FGD retrofit for acid rain legislation. One paper compares spray dryer and wet FGD system costs for hypothetical new and retrofit 500 MW_e installations. Another paper summarized a comprehensive EPRI cost study, including that (a) FGD costs were currently lower (when corrected for inflation) than for previous studies, (b) a number of technologies were very close in costs per ton of SO_2 removed, and (c) 30% reduction in wet FGD costs were obtainable by process simplification; e.g., no spare modules, single absorbers.

A third paper detailed design changes to reduce FGD retrofit costs, while a fourth paper discussed the role of economics in compliance planning strategies. The next two papers discussed retrofit cost considerations specific to the Tennessee Valley Authority system and to 200 candidate retrofit boilers nationwide, respectively. The latter paper also compared proposed U.S. retrofit economics to actual costs experienced in recent West German retrofits.

A seventh paper focused on second-generation wet FGD technologies as retrofit choices while the eighth and final paper discussed strategies to comply with imminent acid rain legislative requirements.

Furnace Sorbent Injection

Emphasis was on design and operation of full-scale facilities. The first paper described furnace lime injection on a 65 MW_t stoker-fired boiler in West Germany followed by a second reaction stage with humidification upstream of an electrostatic precipitator (ESP) for 90% SO_2 removal. Three papers in this session which described experimental studies for limestone and lime sorbents injected into furnaces, while another paper detailed large pilot furnace injection on a 15 MW_t tangential prototype boiler. Three papers described activities at three demonstration sites. Results were presented for lime injection at the 105 MW_e Edgewater and 61 MW_e Whitewater Valley sites, reporting up to 50 and 72% SO_2 removal, respectively. Plans for the 180 MW_e demonstration at the Yorktown No. 2 tangentially fired boiler, to start up in 1992, were discussed in the final paper of this session.

Byproduct Utilization

In Session 3B, Byproduct Utilization, eight papers were presented for waste handling, disposal and re-use in wet FGD, spray dryer FGD, furnace sorbent injection, and new technologies. Three papers dealt specifically with limestone/lime wet FGD sludge utilization as paving materials, aggregates, structural concrete, gypsum, and fertilizer. Other papers discussed potential byproducts from advanced new technologies such as gypsum and ammonium sulfite. Two papers dealt with specific experience in byproduct/waste management efforts: one for the Ohio Edison system and one covering recent experience in West Germany.

FSI Recycle

The Furnace Sorbent Injection (FSI) Recycle Session (4A) consisted of four presentations on the increased utilization of calcium sorbents for in-furnace injection. One paper discussed dust collector recycle of dry sorbent with additives; another discussed similar recycle but by reslurrying and re-injection as a slurry into the furnace. Two other papers discussed more novel reactivation schemes prior to recycle—one process (ARA) steam-treats collected solids prior to recycle into the flue gas, while another (ADVACATE) converts waste solids into calcium silicate prior to reinjection into ductwork.

Wet FGD Reliability

Session 4B, Wet FGD Reliability, consisted of eight papers covering:

- designing systems for load swing (cycling) service
- protective linings for scrubber components
- corrosion prevention/control
- effects of additives on materials of construction
- duct conversion downstream of FGD
- alternatives to gas reheat for duct corrosion prevention

Spray Dryers

Session 4C focused on large pilot- and full-scale commercial applications of spray dryer technology. Two papers covered pilot experience at TVA's Shawnee facility and EPRI's High Sulfur Test Center. One paper described operating experience on an 865 MW_e unit using eight absorbers; a second described vendor experience with spray dryers worldwide. The effect of spray dryer operation on ESP performance was discussed in the remaining papers.

Wet Full-Scale Operation

Session 5 covered the mainstream topic of FGD symposia, that of full-scale operating experiences of wet lime/limestone scrubbers. The session began with an overview of chemical additives for improved operation by the Session Chairman. Nine papers followed on :

- thiosulfate additives on three commercial FGD units
- sodium formate addition on pilot- and full-scale scrubbers
- performance evaluation of magnesium/lime, limestone, gypsum byproduct, and limestone low sulfur coal FGD operations
- evaluation of a Chiyoda wet scrubber system
- scale prevention on a commercial FGD system
- laboratory evaluation of additive losses in FGD
- process modifications to improve FGD performance

Emerging Technologies, Combined SO_x/NO_x Technologies, and Wet FGD Vendor Designs

Sessions 6A, 6B, and 6C were "mini-sessions" consisting of abbreviated presentations of new developments in SO_2 control, specialized topics thought to be of less general interest than conventional FGD technology. The purpose of these sessions was to expose new concepts, while minimizing the time, thus allowing

many topics to be discussed. Sessions and topics covered were:

Emerging Technologies:

- Parsons FGD process
- FGD process using cement kiln waste
- ISPRA Mark 13A process
- plasma-jet SO_2 conversion
- CANSOLV FGD process
- anion-exchange resin dechlorinization
- synergistic reactor for SO_2 control

Combined SO_x/NO_x Technologies:

- overview report on SO_x/NO_x control
- lime-urea hydrate injection
- NOXSO process
- combined SO_x/NO_x control by catalytic system
- combined SO_x/NO_x control in a wet limestone scrubber
- combined SO_x/NO_x by fixed-bed dry sorbent
- dry sorbent injection SO_x/NO_x control

Wet FGD Vendor Designs:

- Flakt wet FGD systems
- West German FGD systems
- Babcock-Hitachi "Intelligent" scrubber
- KRC-Noell wet FGD system
- Pure air FGD process
- Chiyoda wet FGD system

Post-Combustion Dry Technologies

Session 7A, Post-Combustion Dry Technologies, focused on efforts to develop lower cost retrofit technologies using dry sorbents injected into the post-combustion flue gas. These papers included two discussions of dry sodium injection, four papers discussing calcium injection, one paper documenting a combined calcium/sodium dry injection system, and one paper describing a spray dryer within an ESP (E-SO_x).

Wet FGD Research

Session 7B, Wet FGD Research, covers the laboratory- and small-pilot-scale research on wet FGD being conducted primarily at EPRI and its member companies. Topics included mist eliminator performance, limestone utilization, process additives, crystallization studies, combined SO_x/NO_x control in wet scrubbers, and process/economic models developed for industry.

Poster Session

Although not presented formally at the podium, the 1990 SO_2 Symposium conducted a large poster session where FGD-related subjects were discussed face to face between the author and audience. Of these, 13 submitted technical papers which are included in the proceedings. These topics are heavily oriented toward research programs and vary from fly ash effects on SO_2 control, process models, improved FGD components, additives, and corrosion control. Also papers for non-utility applications, especially waste incinerator FGD, were presented in this session.

☆U.S. GOVERNMENT PRINTING OFFICE: 1991 - 548-028/40030