



Project Summary

Proceedings: Eighth Symposium on the Transfer and Utilization of Particulate Control Technology

Geddes H. Ramsey

The proceedings of the Eighth Symposium on the Transfer and Utilization of Particulate Control Technology are contained in two volumes. Volume 1 consists of *New Controls for Precipitators I and II, Innovative Pollution Control Technologies, Precipitator Model Studies, Fly Ash/ESP Studies, Precipitator Plate Spacing Studies, ESP Rapping Studies, ESP Performance Upgrading Studies I and II, Hot-Side Precipitator Studies, and Innovative Pollution Control Technologies*. Volume 2 consists of *Low Ratio Baghouse O&M Experience, Pulse-Jet Baghouse Experience I and II, Particulate Control for AFBCs, Particulate Control for Dry SO₂ Control Process, Baghouse Design & Performance Studies I and II, Fundamental Baghouse Studies, High Temperature Filtration I and II, and Control of Emissions from RDF Incinerators*. The symposium, in San Diego, CA, March 20-23, 1990, was cosponsored by the Environmental Protection Agency and the Electric Power Research Institute.

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 two volumes of the same title (see Project Report ordering information at back).

Introduction

The papers in these two volumes were presented at the symposium which provided an opportunity for the transfer of information on particulate control technology

among manufacturers, users, regulators, and educators. The purpose of the symposium was to advance new ideas and innovative approaches and to share experiences about ongoing technologies.

The main interest of the participants of past symposia has been in electrostatic precipitation (ESP) and fabric filtration, and this interest was reflected in the papers presented at this meeting. The topics of this symposium were ESP, fabric filtration, flue gas desulfurization (FGD), and municipal waste incineration particulate control.

The symposium was conducted in a series of parallel sessions with each session containing two to six related papers. The sessions were arranged to present the ESP-related papers in one session while the fabric filtration-related papers were presented in the other session, thus avoiding the possibility of sessions dealing with the same topic. The papers have been divided into two volumes to conform with the two-session format.

Volume 1 Papers

Volume 1 describes various aspects of ESP control. Various aspects of ESP performance enhancement were discussed, such as rapping improvements, intermittent energization, increased plate spacing, multistage ESPs, and chemical conditioning. Papers also describe new computer control for ESPs and the effects of resistivity of fly ash/sorbent mixtures on ESPs. Papers were also presented that describe ESP performance modeling. One session investigated innovative pollution control technologies including corona destruction for DeNO_x, DeSO_x, and volatile organic compounds.



Session 1A: New Controls for Precipitators I

New Controls for Precipitators I Advanced Microprocessor Technology for Electrostatic Precipitator High Voltage Control Systems
Edwin H. Weaver, Belco Technologies, Inc.

Case Study of CP&L's Coletto Creek Power Station, Joy-Western Hot-Side Electrostatic Precipitator

Elliott M. Drysdale, Forry, Inc., David Wakefield, Wakefield Associates, Inc., and John Wester, Central Power and Light

An Evaluation of the Energy Savings and Electrical Waveforms from an Intermittent Energization of Electrostatic Precipitators at Coal Fired Stoker Utility Boilers

Peter Gelfand, P. Gelfand Associates, J.A. Alden, D.J. McKay, and C.M. Richardson, New York State Electric and Gas Corporation

Session 2A: New Controls for Precipitators II

Intermittent Energization Optimization on PSI Gibson Station-Unit #1 Precipitator
Steve Szczecinski, J. Lantz, Neundorfer, Inc., and R. Pepmeier, Public Service Indiana

Full Scale Demonstration of Intermittent Energization on a 500 MW Hot-Side Electrostatic Precipitator

Wallis A. Harrison, Robert P. Gehri, Southern Company Services, E.C. Landham, Jr., Southern Research Institute, Morris B. Tuck, Mississippi Power Company, and Walter Piulle, Electric Power Research Institute

Experimental Evaluation of Improved Design of ESPs

B. Bellagamba, G. Dinelli, and E. Riboldi, ENEL-Thermal and Nuclear Research Center

Delaying Sodium Depletion in Electrostatic Precipitators at Ghent Generating Station
Carla Clay Robinson, Kentucky Utilities Company

Session 3A: Innovative Pollution Control Technologies

DeSO_x and DeNO_x by PPCP and SPCP
Senichi Masuda, Fukui Institute of Technology, and J. Wang, Anshan Research and Design Institute

The Destruction of Volatile Organic Compounds by an Innovative Corona Technology

Geddes H. Ramsey, Norman Plaks, Chester A. Vogel, Wade H. Ponder, U.S. EPA/AEERL, and Larry E. Hamel, Acurex Corporation

Application of Corona-Induced Plasma Reactors to Decomposition of Volatile Organic Compounds

Toshiaki Yamamoto, P.A. Lawless, K. Ramanathan, D.S. Ensor, Research Triangle Institute, G.H. Ramsey, and N. Plaks, U.S. EPA/AEERL

Session 4A: Precipitator Model Studies

Requirements for a Precipitator Performance Expert System

John G. Musgrove, Bechtel Power Corporation, and Robert L. Jeffcoat, Southern Research Institute

An Integrated Electrostatic Precipitator Model for Microcomputers

P.A. Lawless, Research Triangle Institute, and R.F. Altman, Electric Power Research Institute

An Advanced Microcomputer Model for Electrostatic Precipitators

P.A. Lawless, Research Triangle Institute, and N. Plaks, U.S. EPA/AEERL

Measurements Inside a Model Precipitator
A.L.H. Braam and W. Hiemstra, N.V. KEMA

Session 5A: Fly Ash/ESP Studies

The Effects of Fireside Process Conditions on Electrostatic Precipitator Performance in the Electric Utility Industry

Herbert J. Hall, H.J. Hall Associates, Inc.

Observations of Modeled and Laboratory Measured Resistivity

Roy E. Bickelhaupt, Clean Air Engineering, Inc.

Session 6A: Precipitator Plate Spacing Studies

Engineering Study on Wide Plate Spacing Electrostatic Precipitators

K.S. Kumar and P.L. Feldman, Research-Cottrell, Inc.

Increased Plate Spacing in Electrostatic Precipitators

Ken Darby and David Novogoratz, Dresser Industries, Inc.

Mechanisms of Performance Enhancement in Wide Plate Electrostatic Precipitators

H. Elshimy and G.S.P. Castle, The University of Western Ontario

Session 7A: ESP Rapping Studies

Characteristics of Rapping Acceleration in Precipitator Collecting Plates Before and After the Installation of Plate Straightening Devices

Jeffrey Cummings, Neundorfer, Inc. Temperature Dependency of Magnetic Impact Rappers

Michael W. Neundorfer, Karl M. Artz, and Michael A. McNabb, Neundorfer, Inc.

Experimental Study of Ash Rapping Off the Collector Plates in a Lab-Scale Electrostatic Precipitator

D.H. Choi, S.A. Self, M. Mitchner, and R. Leach, Stanford University

Session 8A: ESP Performance Upgrading Studies I

Meeting Emission Levels Through Precipitator Upgrades

Sanford F. Weinman and Kenneth R. Parker, Dresser Industries, Inc.

Operating Experience of the Rigid Frame Electrostatic Precipitator Installed at Metropolitan Edison Company's Portland Station

Paul G. Abbott, Theodore C. Schafebook, General Electric Environmental Systems, and

John A. Brummer, Metropolitan Edison Company

Modern Electrode Geometries and Voltage Waveforms Minimize the Required SCAs

Kjell Porle, Sten Maartmann, Mats-Olof Bergstrom, Flakt Industriella Processer AB, and Keith Bradburn, Flakt, Inc.

ESP Design Concepts for Improving Performance and Reliability

John R. Meinders, Kansas City, Kansas Board of Public Utilities, and Robert E. Jonellis, PrecipTech, Inc.

Session 9A: ESP Performance Upgrading Studies II

Considerations in Rebuilding the Sibley Unit 1 Precipitator

D.I.A. Greashaber, Missouri Public Service, and P.A. Hiller, Sargent & Lundy

Flue Gas Field Study, Model Study, and a Post Study Review to Improve the Performance of a Chevron ESP at Duke Power's Belwus Creek Station

Scott L. Thomas, Duke Power Company, and Lawrence A. Zemke, CAE Diagnostic Services

Experience with Dual Flue Gas Conditioning of Electrostatic Precipitators

H.V. Krigmont and E.L. Coe, Jr., Wahlico, Inc.

Session 10A: Hot-Side Precipitator Studies

Modification and Conversion of the Nebraska City Unit 1 Hot ESP to Cold-Side Operation

A.W. Ferguson, R.C. Wicina, B.L. Duncan, Black and Veatch Engineers-Architects, K.A. Roth and R.M. Kotan, Omaha Public Power District

Results of the Roy S. Nelson Unit 6 Hot-Side Precipitator Structural Evaluation

C.R. Reeves, Gulf States Utilities Co., S.A. Johnson and R.L. Schneider, Sargent & Lundy
Columbia Unit 2 Precipitator Hot to Cold Conversion

Mohammad Vakili, Wisconsin Power and Light Company, and A.W. Ferguson, Black and Veatch Engineers-Architects

Session 11A: Innovative Pollution Control Technologies

Improved Carbon Particulate Control Via Additive Injection

D. Farrar, University of Toronto, J. Reuther, Battelle Columbus, W. Steiger, Battelle Frankfurt, R. Schmitt, Battelle Geneva, and R. van der Velde, Velino Ventures

Volume 2 Papers

Volume 2 describes various aspects of fabric filtration, particulate control for atmospheric, fluidized-bed combustors (AFBCs) and for dry sulfur dioxide (SO₂) control processes, and control of emissions from municipal waste incinerators. Papers are presented dealing with the emissions from sewage sludge incinerators which include dry particulates, organic condensates, mercury, nitrogen oxides, and sulfur oxides. Operation of fabric filters and ESPs in FGD were presented. Particulate and SO₂ control with the E-SO_x process was also presented. In addition, high temperature filtration studies were also presented such as ceramic filters, innovative filter bags, and electrified granular filters.

Session 1B: Low Ratio Baghouse O&M Experience

The O&M History at the City of Colorado Springs, Martin Drake Unit No. 6 Reverse Gas Fabric Filter System

Richard L. Miller, General Electric Environmental Systems, and Leslie V. Hekkers, City of Colorado Springs
1990 Update, Operating History, and Current Status of Fabric Filters in the Utility Industry

Kenneth M. Cushing, Randy L. Merritt, Southern Research Institute, and Ramsay L. Chang, Electric Power Research Institute

Session 2B: Pulse-Jet Baghouse Experience I

Australian Experience with High Ratio Fabric Filters On Utility Boilers

Peter R. Heeley, The Electricity Commission of New South Wales, and Colin Robinson, Flakt Australia Ltd.

A Ten Year Review of Pulse-Jet Baghouse Operation and Maintenance at the H.R. Milner Generating Station

Brian R. Thicke, Alberta Power Limited
Design and Performance Evaluation of a 350 MW Utility Boiler Pulse-Jet Fabric Filter

Peter W.R. Funnell, Stig Strangert, Flakt Australia Ltd., and Peter R. Heeley, The Electricity Commission of New South Wales

A Survey of the Performance of Pulse-Jet Baghouses for Application to Coal-Fired Boilers, Worldwide

Victor H. Belba, Consultant, Theron Grubb, Grubb Filtration Testing Services, Inc., Ramsay Chang, Electric Power Research Institute

Session 3B: Pulse-Jet Baghouse Experience II

Retrofit of Fabric Filters to Power Boilers
Howard F. Johnson, Howden Environmental Systems, Inc.

The EPRI Pilot Pulse-Jet Baghouse Facility at Plant Scholz

K.J. Mills, Southern Company Services, and R.F. Heaphy, Southern Research Institute

Pilot Demonstration of a Pulse-Jet Fabric Filter for Particulate Matter Control at a Coal-Fired Utility Boiler

Robert C. Carr, Electric Power Technologies, Inc., and C.J. Bustard, ADA Technologies, Inc.

Plenary Session

Acid Rain Regulations in Germany and Their Effects

Peter Davids, State Agency for Air Pollution Control and Noise Abatement, Federal Republic of Germany

Particulate Emissions Control and Its Impacts on the Control of Other Air Pollutant Emissions from Municipal Waste Combustors

Theodore G. Brna and James D. Kilgroe, U.S. EPA/AEERL

Session 4B: Particulate Control for AFBCs

Baghouse Design Consideration Unique to Fluidized Bed Boilers

Joseph B. Landwehr, Fred W. Campbell, and J. Gary Weis, Burns & McDonnell Engineering Company, Inc.

Fabric Filter Monitoring at the CUEA Nucla AFBC Demonstration Plant

Kenneth M. Cushing, Southern Research Institute, Thomas J. Heller, Consolidated Edison Company of New York, Ralph F. Altman, Thomas J. Boyd, Mike A. Friedman, and Ramsay

L. Chang, Electric Power Research Institute

Electrostatic Precipitation of Particles Produced by Three Utility Fluidized-Bed Combustors Service

E.C. Landham, Jr., M.G. Faulkner, R.P. Young, Southern Research Institute, Ralph F. Altman, and Ramsay L. Chang, Electric Power Research Institute

Session 5B: Particulate Control for Dry SO₂ Control Process

Effects of E-SO_x Technology on ESP Performance

G.H. Marchant, Jr., J.P. Gooch, M.G. Faulkner, Southern Research Institute, and L.S. Hovis, U.S. EPA/AEERL

Identification of Low-Resistivity Reentrainment in ESPs Operating in Dry Scrubbing Applications

Michael D. Durham, ADA Technologies, Inc., Richard G. Rhudy, Electric Power Research Institute, Thomas A. Burnett, Jose DeGuzman, Gerald A. Hollinden, Tennessee Valley Authority, Robert A. Barton, and Charles W. Dawson, Ontario Hydro
Electrostatic Precipitation of Particles Produced by Furnace Sorbent Injection at Edgewater

Ralph F. Altman, Ramsay L. Chang, Electric Power Research Institute, E.C. Landham, Jr., E.B. Dismukes, M.G. Faulkner, R.P. Young, Southern Research Institute, and Louis S. Hovis, U.S. EPA/AEERL

Proposed Demonstration of HYPAS on Duke Power's Marshall Station Unit 2: An Integrated Approach to Particulate Upgrades and SO₂ Control

Kris W. Knudsen, Duke Power Company, Robert C. Carr, Electric Power Technologies, and Richard G. Rhudy, Electric Power Research Institute

Session 6B: Baghouse Design & Performance Studies I

Influence of a Sock Between Supporting Cage and Bag On Filter Performance
Eberhard Schmidt and F. Loffler, Universitat Karlsruhe

Accelerated Bag Wear Testing

Larry G. Felix, Robert F. Heaphy, Southern Research Institute, Ralph F. Altman, Ramsay L. Chang, Electric Power Research Institute, and W. Theron Grubb, Grubb Filtration and Testing Services, Inc.

Collection of Reactive and Cohesive Fine Particles in a Bag Filter with Pulse-Jet Cleaning Filter Performance
Eberhard Schmidt and F.

Loffler, Universitat Karlsruhe
DuPont's Engineering Fibers for Hot Gas
Filtration Case Histories
Peter Frankenburg, E.I. DuPont de
Nemours & Co., Inc.

Plenary Session

Advanced Power System
Particulate Control Technology
T.F. Bechtel and W.T. Langan, U.S.
DOE
Future Directions in Particulate Control
Technology
Sabert Oglesby, Southern Research
Institute

Session 7B: Baghouse Design and Performance II

Optimizing Baghouse Performance at
Monticello Station with Ammonia Injection
Kent Duncan, Robbie Watts, Monticello
Steam Electric Station, Randy L.
Merritt, P. Vann Bush, Southern
Research Institute, Walter V. Piulle,
and Ramsay L. Chang, Electric Power
Research Institute

Enhancing Baghouse Performance with
Conditioning Agents: Basis, Developments,
and Economics

S.J. Miller and D.L. Laudal, University
of North Dakota

Baghouse Performance Advisor: A Knowl-
edge Based Baghouse Operator Advisor
James P. Enkenrode, Gary P. Greiner,
ETS, Inc.,

Earl Lewis, Baltimore Gas and Electric
Company, and Ramsay L. Chang,
Electric Power Research Institute

Efficiency of Fabric Filters and ESPs in
Controlling Trace Metal Emissions from
Coal-Burning Facilities

Roger C. Trueblood, Christopher
Wedig, and Richard J. Gendreau, Stone
& Webster Engineering Corporation

Session 8B: Fundamental Baghouse Studies

The Structural Analysis of Dust Cakes
Eberhard Schmidt and F. Loffler,
Universitat Karlsruhe
Effects of Additives and Conditioning Agents
on the Filtration Properties of Fly Ash
P. Vann Bush and Todd R. Snyder,
Southern Research Institute

Particle Size Effects on High Temperature
Dust Filtration from a Coal-Fired Atmo-
spheric Fluidized-Bed Combustor
Richard A. Dennis, Larry D. Strickland,
and Ta-Kuan Chiang, U.S. DOE,
Morgantown Energy Technology Center
Institute

Generalization of Laboratory Dust Cake
Characteristics for Full-Scale Applications
Ta-Kuan Chiang, Richard A. Dennis,
Larry D. Strickland, and Charles M.
Zeh, U.S. DOE, Morgantown Energy
Technology Center Institute

Session 9B: High Temperature Filtration I

High Temperature Filtration Using Ceramic
Filters

L.R. White and S.M. Sanocki, 3M
Company

High Temperature Filter Media Evaluation
D.J. Helfritsch and P.L. Feldman,
Research-Cottrell

Pilot-Scale Performance/Durability Evalua-
tion of 3M Company's High-Temperature
Nextel Filter Bags

G.F. Weber and G.L. Schelkoph,

University of North Dakota
Particulate Control in Advanced Coal-based
Power Generating Systems
S.J. Bossart and C.V. Nakaishi, U.S.
DOE Morgantown Energy Technology
Center

Session 10B: High Temperature Filtration II

Performance of a Hot Gas Cleanup Sys-
tem on a Pressurized Fluidized-Bed Com-
bustor

Jans Andries, J. Bernard, B. Scarlett,
Delft University of Technology, and B.
Pitchumani, I.I.T. Hauz Khas

Electrified Granular Filter for High Tem-
perature Gas Filtration

P.H. deHaan, TNO Center for
Polymeric Materials, M.L.G. van
Gasselt, and L.M. Rappoldt, TNO
Division for Society

Nested Fiber Filter for Particulate Control
Robert D. Litt and H. Nicholas Conkle,
Battelle

Session 11B: Control of Emissions from RDF Incinerators

Particulate Emissions from Prepared Fuel
(RDF) Municipal Waste Incinerators

R.M. Hartman, Resource Recovery
Systems

Condensable Emissions from Municipal
Waste Incinerators

Ashok S. Damle, David S. Ensor,
Research Triangle Institute, and
Norman Plaks, U.S. EPA/AEERL

Treatment of Flue Gas and Residues from
Municipal and Industrial Waste Incinerators
G. Mayer-Schwinning, Lurgi G.m.b.H.

Geddes H. Ramsey is the EPA Project Officer (see below).

The complete report, entitled "Proceedings: Eighth Symposium on the Transfer and Utilization of Particulate Control Technology," consists of two volumes:

"Volume I" (Order No. PB94-158938; Cost: \$52.00; subject to change)
describes various aspects of ESP control.

Volume II (Order No. PB94-158946; Cost: \$77.00; subject to change)
describes various aspects of fabric filtration, particulate control for atmospheric fluidized-bed combustors and for dry sulfur dioxide control processes, and control of emissions from municipal waste incinerators.

Both volumes of this report will be available only from:

National Technical Information Service
5285 Port Royal Road
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