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Industrial Environmental Research
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Research Triangle Park NC 27711

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Report Abstracts

Industrial Environmental Research Laboratory RTP

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
INDUSTRIAL ENVIRONMENTAL RESEARCH LABORATORY
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July 1980

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TECHNICAL REPORT DATA
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1. REPORT NO. EPA-600/2-79-201	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Sampling and Analysis of Reduced and Oxidized Species in Process Streams--Final Report		5. REPORT DATE November 1979
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) R. F. Maddalone, L. L. Scinto, and M. M. Yamada		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS TRW Defense and Space Systems Group One Space Park Redondo Beach, California 90278		10. PROGRAM ELEMENT NO. INE624
		11. CONTRACT/GRANT NO. 68-02-2165, Task 221
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Final; 7/76 - 8/79
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is Frank E. Briden, Mail Drop 62, 919/541-2557.

16. ABSTRACT The report gives results of a program of over 60 tasks involving the evaluation, development, testing, and field adaptation of measurement techniques for elemental analysis and inorganic compound identification in process and effluent streams. Procedures for particulate sampling at the inlet and outlet of FGD systems were developed. Methods for H2SO4 sampling in flue gas streams were developed based on the controlled condensation of H2SO4 vapor (a manual procedure was used as the basis for an automated H2SO4 monitoring instrument that was built and tested). Two procedure manuals were written for reduced and oxidized inorganic species. The reduced species manual detailed GC and GC/MS procedures for identifying organometallic compounds as well as homologous series such as RSH and RNH. The oxidized species were identified using an integrated series of analytical methods such as AAS, ICAP, XRD, FTIR, ESCA, and SEM-EDX. The procedures developed, applied to samples from several EPA programs, showed that the analysis scheme is applicable to most solid samples from combustion sources. Ion chromatographic procedures were also developed for analyzing FGD system slurry streams. The use of pH and chloride electrodes for controlling FGD systems was investigated. The methodology for coal flow monitors was reviewed.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Pollution	Oxidation	Pollution Control	13B	
Sampling	Industrial Processes	Stationary Sources	14B	13H
Analyzing	Dust	Particulate		11G
Measurement	Aerosols			07D
Inorganic Compounds			07B	
Reduction (Chemistry)				
Sulfuric Acid				

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1. REPORT NO. EPA-600/2-80-040	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Demonstration of a Closed Loop Reuse System in a Fiberglas Textile Plant		5. REPORT DATE January 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) S.H. Thomas and D.R. Walch		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Owens-Corning Fiberglas Corporation Fiberglas Tower Toledo, Ohio 43601		10. PROGRAM ELEMENT NO. 1BB610
		11. CONTRACT/GRANT NO. S801173
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Final; 5/73 - 12/79
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is Max Samfield, Mail Drop 62, 919/541-2547.

16. ABSTRACT The report describes work done toward providing a totally recycled water system for Owens-Corning's textile fiber manufacturing plant at Anderson, SC. (The work was based on pre-1968 pilot plant work by Owens-Corning that resulted in development of totally recycled industrial wastewater systems for all of their insulation manufacturing plants.) Water quality requirements for the Anderson plant were considerably more stringent than for insulation manufacturing. Test and engineering design work started in 1973. Design work was completed in March 1977 and actual field work was started. All sanitary wastes from the plant were segregated for separate treatment. Much modification to the existing treatment was required to improve the quality of primary and secondary effluent for tertiary treatment. In the final process, biologically treated effluent is sand-filtered, followed by activated carbon adsorption and disinfection with chlorine. Major items of equipment added were a commercial upflow pressure sand filter and three upflow activated carbon columns with backwash capabilities. The quality of treated effluent is completely satisfactory for all plant operating requirements. Total recycle of treated effluent was realized in mid-1978 and has continued since then. Complete closed-loop operation had not yet been achieved. Discharge to Betsy Creek has been greatly reduced.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Pollution	Insulation	Pollution Control	13B	14B
Textile Industry	Sand Filters	Stationary Sources	11E	13K
Textile Processes	Activated Carbon		13H	11G
Glass Fibers	Chlorine		11B	07B
Waste Water				
Water Treatment				

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1. REPORT NO. EPA-600/2-80-054	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Supercritical Fluid Regeneration of Activated Carbon for Adsorption of Pesticides		5. REPORT DATE March 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) R. P. DeFilippi, V. J. Kyukonis, R. J. Robey, and M. Modell		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Arthur D. Little, Inc. 20 Acorn Park Cambridge, Massachusetts 02140		10. PROGRAM ELEMENT NO. 1BB610
		11. CONTRACT/GRANT NO. Grant R804554
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Task Final; 1/77-5/79
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is Max Samfield, Mail Drop 62, 919/541-2547.

16. ABSTRACT

The reportdescribes the development of a new process for regenerating activated carbon, using supercritical CO2 as a desorbent. Supercritical CO2 in the range of 30-250 C and at pressures ⩾ 80 atm. is a good solvent for organics. A series of pesticides was tested for treatment by carbon adsorption and supercritical CO2 regeneration. Alachlor and atrazine, selected for further study, both permitted regeneration over multiple cycles with a low average loss per cycle. All pesticides tested showed a substantial capacity decline (30-plus%) after one generation, but after several cycles both alachlor and atrazine exhibited a stable working capacity. Regeneration is rapid. Water in the carbon pores is not detrimental, at least not at 120 C. Shorter exposure time of carbon to adsorbent resulted in less first-cycle decline. Desorption rates increased with temperature, and higher regeneration pressures (150-275 atm.) gave improved regenerability. Treatability studies on a plant sample of atrazine manufacturing wastewater indicated a stable but low working capacity of carbon. Working capacities of 0.05 to 0.08 g TOC per g carbon were obtained at regeneration pressures of 150-275 atm. at 120 C.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Pollution	Carbon Dioxide	Pollution Control	13B	07B
Pesticides	Supercritical Flow	Stationary Sources	06F	20D
Adsorption	Waste Water	Supercritical CO2	14B	
Activated Carbon	Water Treatment	Alachlor	11G	
Regeneration		Atrazine		
Desorption			07D,07A	

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1. REPORT NO. EPA-600/2-80-075c	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Assessment of Atmospheric Emissions from Petroleum Refining: Volume 3. Appendix B		5. REPORT DATE April 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) R. G. Wetherold, L. P. Provost, and C. D. Smith		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Radian Corporation P.O. Box 9948 Austin, Texas 78766		10. PROGRAM ELEMENT NO. 1AB604
		11. CONTRACT/GRANT NO. 68-02-2147, Exhibit B
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Final; 3/76-6/79
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is Bruce A. Tichenor, Mail Drop 62, 919/541-2547.

16. ABSTRACT

The report gives results of a 3-year program to assess the environmental impact of petroleum refining atmospheric emissions. This volume contains a detailed compilation of the data and a summary of the results obtained from measurements taken at 13 refineries throughout the U.S. The sampled sources included valves, flanges, pump and compressor seals, relief valves, drains, cooling towers, oil/water separators, dissolved air flotation units, and various process stacks. Nonmethane hydrocarbon emission factors for the various fugitive emission sources are presented. Nomographs illustrating the relationship between screening (monitoring) values and emission rates are included. Correlations of leak rates with various process and equipment parameters are graphically displayed. The frequency and distribution of emission sources in refineries are estimated. The effect of simple valve maintenance on valve leak rates is described. Many organic species present in liquid process streams and vapor emissions were identified and quantified. These species and their concentrations in the various streams are listed.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Pollution	Maintenance	Pollution Control	13B	15E
Petroleum Refining	Organic Compounds	Stationary Sources	13H	
Assessments		Nonmethane Hydrocarbons	14B	
Sampling				
Analyzing				
Hydrocarbons			07C	

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1. REPORT NO. EPA-600/2-80-077a	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Treatability Studies of Pesticide Manufacturing Wastewaters: Carbaryl		5. REPORT DATE April 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Edward Monnig, Michael Murphy, Ruth Sweidinger, and Linda Little		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Research Triangle Institute P.O. Box 12194 Research Triangle Park, North Carolina 27709		10. PROGRAM ELEMENT NO. 1BB610
		11. CONTRACT/GRANT NO. 68-02-3688, Task 109
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Task Final; 2/78-3/80
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is David C. Sanchez, Mail Drop 62, 919/541-2547.

16. ABSTRACT The report gives results of a bench-scale, experimental treatability study of wastewaters from the manufacture of the pesticide carbaryl. Results indicate that both carbaryl manufacturing wastewater (mixed one part in nine parts municipal wastewater) and carbaryl itself (spiked at 10 mg/L in municipal wastewater) appear suitable for biological treatment by acclimated systems if additional provision is made for removing ammonia in the effluents from these biological treatment systems. Other parameters investigated in this study--including carbaryl, alpha-naphthol, and toluene concentrations and the chemical oxygen demand (COD)--all showed large reductions (90% or greater). The mechanisms of reduction of these parameters include combined hydrolysis and biodegradation of carbaryl and alpha-naphthol, volatilization of toluene, and biodegradation of species contributing to COD. A large increase in ammonia concentration was noted in the effluent from the biological units treating carbaryl manufacturing wastewater. This ammonia concentration made the toxicological evaluation of the effectiveness of treatment problematic by rendering the effluent more toxic than the influent. Ammonia stripping lessened this toxicity. Because the technology of nitrogen control has been extensively developed, these treatment options were not pursued further.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Pollution	Nitrogen	Pollution Control	13B	
Pesticides	Naphthols	Stationary Sources	06F	07C
Industrial Processes		Carbaryl	13H	
Waste Water	Toluene	Treatability		
Waste Treatment	Toxicity	Alpha-naphthol		06T
Ammonia	Oxygen Demand	Chemical Oxygen Demand	07B	06P

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TECHNICAL REPORT DATA
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1. REPORT NO. EPA-600/2-80-088	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Evaluation of a Commercial Vacuum System for the Removal of Asbestos		5. REPORT DATE May 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) R. W. Welker, D. F. Finn, J. D. Stockham, and R. P. Hancock		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Illinois Institute of Technology Research Institute 10 West 35th Street Chicago, Illinois 60616		10. PROGRAM ELEMENT NO. C1Y-L1B
		11. CONTRACT/GRANT NO. 68-02-2617, Task 10
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Task Final; 10-12/79
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is David C. Sanchez, Mail Drop 62, 919/541-2547.

16. ABSTRACT The report gives results of a brief field study that included measurement of personal, area, and environmental asbestos exposures resulting from wet and dry asbestos removal using a commercial vacuum system. Personal and area (indoor) asbestos concentrations during dry removal were less than 1 fiber/cu cm, as measured by NIOSH P and CAM 239 when the vacuum system was used. Asbestos released to the environment from the vacuum system's three-stage exhaust filter was negligible. Asbestos was released from the operator's protective garments when he exited the work area to service the vacuum system. Sources of asbestos fiber release associated with vacuum system operation were identified; these occurred during operation, disassembly, and asbestos disposal. Following vacuum shutdown, liquid drained from the collection reservoir due to inadequate door seals. During vacuum hose disassembly, bulk losses of asbestos-containing materials occurred. During disposal, the exterior of the vacuum truck became contaminated as the reservoir was emptied. Additional dry removal testing is required.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Pollution	Pollution Control	13B
Asbestos	Stationary Sources	11E
Vacuum Cleaners		13G
Vacuum Filters		13K
Vacuum Filtration		07A

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TECHNICAL REPORT DATA
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1. REPORT NO. EPA-600/2-80-106	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Environmental Assessment of Dry Coke Quenching Vs. Continuous Wet Quenching		5. REPORT DATE May 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) C.W. Westbrook and D.W. Coy		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Research Triangle Institute P.O. Box 12194 Research Triangle Park, North Carolina 27709		10. PROGRAM ELEMENT NO. 1AB604C
		11. CONTRACT/GRANT NO. 68-02-3152, Task 1
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Task Final; 9-10/79
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is Robert C. McCrillis, Mail Drop 62, 919/541-2733.

16. ABSTRACT

The report gives results of an assessment of the multimedia environmental impacts of continuous wet and dry quenching at National Steel's Weirton, West Virginia, Brown's Island coke plant. The report, based primarily on design data, test data from related processes, and engineering judgement, suffers from the lack of definitive test data. The assessment indicates that dry coke quenching results in less particulate matter emitted, less solid waste generated, less process-related gas emitted, and potentially less emission of polynuclear aromatic hydrocarbons and organics in general, than wet quenching. Dry coke quenching also results in increased aqueous effluents and fugitive emissions from coke transport and screening. The assessment concludes that, with proper wastewater treatment and control of coke transport emissions, the dry quench process should have less negative environmental impact than continuous wet quenching. The report identifies areas where data are insufficient for Level 1 assessment and indicates the testing required for a complete Level 1 assessment.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Pollution	Aerosols	Pollution Control	13B	07D
Assessments	Waste Water	Stationary Sources	14B	
Coking	Water Treatment	Environmental Assessment	13H	
Quenching (Cooling)				
Iron and Steel Industry		Coke Quenching	11F	
Dust		Particulate	11G	

18. DISTRIBUTION STATEMENT Release to Public	19. SECURITY CLASS *(This Report)* Unclassified	21. NO. OF PAGES 38
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TECHNICAL REPORT DATA
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1. REPORT NO. EPA-600/7-79-158b	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Chemically Active Fluid Bed for SOx Control: Volume II. Spent Sorbent Processing for Disposal/ Utilization		5. REPORT DATE December 1979
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) C.H. Peterson		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Westinghouse Research and Development Center 1310 Beulah Road Pittsburgh, Pennsylvania 15235		10. PROGRAM ELEMENT NO. EHB536
		11. CONTRACT/GRANT NO. 68-02-2142
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Final; 7/75-10/79
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is Samuel L. Rakes, Mail Drop 61, 919/541-2825.

16. ABSTRACT The report describes the processing of spent calcium-based sulfur sorbents (limestones or dolomites) from an atmospheric-pressure, chemically active fluid bed (CAFB) gasification process, using a regenerative sulfur sorbent process that produces low- to intermediate-Btu gas. Data are developed to provide a basis for evaluating process concepts to minimize the environmental impact (heat release, H2S release, and potential leachates) or possibly for spent sorbent utilization. Flow diagrams and cost estimates were prepared for five processing options. A dry sulfation process operating at 850 C to produce spent solids containing CaSO4 acceptable for disposal and low-temperature ash blending to produce a material for disposal or utilization is recommended for further development. A concept for briquetting to produce aggregate is presented as a low-temperature blending option based on laboratory tests that produced compacts with compressive strengths up to 80 MPa. Direct disposal, dead-burning for disposal by heating at 1250 C and reducing the sulfide content to < 0.03%, and sintering at 1550 C to release the sulfur for recovery and produce a possible source of lime containing < 0.15% sulfur are also investigated. Processing sorbent from a once-through sorbent process containing CaS is also considered.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Pollution	Aggregates	Pollution Control	13B	11G
Fluidized Bed Processing		Stationary Sources	13H, 07A	
Coal Gasification	Briquetting	Chemically Active Fluid Bed Process		
Calcium Carbonates	Waste Disposal			
Regeneration	Combustion	Spent Sorbent Processing		21B
Sulfation		Dead Burning	07C, 07B	

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1. REPORT NO. EPA-600/7-79-178b	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Technology Assessment Report for Industrial Boiler Applications: Oil Cleaning		5. REPORT DATE November 1979
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) E.A. Comley, R.T. Keen, and M.F. Tyndall		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Catalytic, Inc. P.O. Box 240232 Charlotte, North Carolina 28224		10. PROGRAM ELEMENT NO. INE825
		11. CONTRACT/GRANT NO. 68-02-2604, Task 2
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Task Final; 6/78 - 9/79
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is Samuel L. Rakes, Mail Drop 61, 919/541-2825.

16. ABSTRACT The report gives results of an assessment of the applicability of oil cleaning technology to industrial boilers. It gives the status of development and performance of alternative oil cleaning techniques and the cost, energy, and environmental impacts of the most promising processes. Hydrotreating processes (HDS, hydrodesulfurization) which produce cleaned liquid fuels are considered the best system of emission reduction applicable to oil-fired industrial boilers. Processes which clean oil by gasification are either not generally suited to the small scale of industrial boilers (POX) or are not commercially demonstrated (CAFB). The average capital investment, as well as the overall energy requirements, increase with increasing degree of desulfurization. The cost impact of providing low sulfur distillate oil for firing small commercial boilers is minimal. The cost impact of using residual fuel oil is much more dramatic. The cost of HDS escalates quite rapidly with the degree of desulfurization in a given oil. For the distillate oil, there is a 6.7% premium for 0.3% S oil, and 7.7% for 0.1% S. For residual oil the premium ranges from 6.7-18.6% (for oil desulfurized to 1.6% S) to 39-43.1% (desulfurized to 0.1% S). The cost of HDS ranges from $0.91/B (for 1.6% S) to $5.28/B (for 0.1% S).

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Pollution	Assessments	Pollution Control	13B
Fuel Oil	Desulfurization	Stationary Sources	11H,21D
Cleaning		Oil Cleaning	13H
Gasification		Industrial Boilers	07A
Boilers		Hydrotreating	13A
Emission			14B

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1. REPORT NO. EPA-600/7-79-228c	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Coal Conversion Control Technology Volume III. Economic Analysis; Appendix		5. REPORT DATE October 1979
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) L.E. Bostwick, M.R. Smith, D.O. Moore, and D.K. Webber		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Pullman Kellogg 16200 Park Row, Industrial Park Ten Houston, TX 77084		10. PROGRAM ELEMENT NO. EHE 623A
		11. CONTRACT/GRANT NO. 68-02-2198
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Final; 4/77 - 11/78
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is Robert A. McAllister, Mail Drop 61, 919/541-2160.

16. ABSTRACT

This volume is the product of an information-gathering effort relating to coal conversion process streams. Available and developing control technology has been evaluated in view of the requirements of present and proposed federal, state, regional, and international environmental standards. The study indicates that it appears possible to evolve technology to reduce each component of each process stream to an environmentally acceptable level. It also indicates that such an approach would be costly and difficult to execute. Because all coal conversion processes are net users of water, liquid effluents need be treated only for recycling within the process, thus achieving essentially zero discharge. With available technology, gaseous emissions can be controlled to meet present environmental standards, particulates can be controlled or eliminated, and disposal of solid wastes can be managed to avoid deleterious environmental effects. This volume (III) includes both a program for economic analysis of control technology and the appendix.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Pollution	Pollution Control	13B
Coal Gasification	Stationary Sources	13H
Coal Preparation	Coal Conversion	13I
Economic Analysis		05C

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1. REPORT NO. EPA-600/7-80-001	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Definitive SOx Control Process Evaluations: Limestone, Lime, and Magnesia FGD Processes		5. REPORT DATE January 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) K. D. Anderson, J. W. Barrier, W. E. O'Brien, and S. V. Tomlinson		8. PERFORMING ORGANIZATION REPORT NO. ECDP-B7
9. PERFORMING ORGANIZATION NAME AND ADDRESS TVA, Office of Power Emission Control Development Projects Muscle Shoals, Alabama 35660		10. PROGRAM ELEMENT NO. INE624A
		11. CONTRACT/GRANT NO. EPA IAG-D9-E721-BI (TVA TV-41967A)
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Final; 6/78 - 9/79
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is C.J. Chatlynne, Mail Drop 61, 919/541-2915.

16. ABSTRACT The report gives economic and ground-to-ground energy evaluations of limestone slurry, lime slurry, and magnesia (producing sulfuric acid) flue gas desulfurization (FGD) processes. The lime slurry process, using purchased lime and lime calcined onsite, remains lower in capital investmant (90 $/kW for the base-case 500-MW power plant burning 3/5% sulfur coal) than the limestone slurry process (98 $/kW). The limestone slurry process remains lower in annual revenue requirements (4.02 mills/kWh) than the lime slurry process (4.25 mills/kWh). The magnesia process is about one-third higher in capital investment (132 $/kW) and one-fourth high in annual revenue requirements (5.05 mills/kWh including credit for acid sales) than the limestone slurry process, because of absorbent-recovery and acid-producing complexities. The lime slurry process using purchased lime is more economical than the limestone slurry process at low absorbent consumption rates (below about 200 MW or 2% sulfur coal). Onsite lime calcination becomes economical compared to purchased lime for larger power plants and higher coal sulfur levels (about 1000 MW with 3.5% sulfur coal, 750 MW with 5% sulfur coal). The limestone slurry process has the lowest overall (raw material, FGD, and disposal) energy requirements (26% less than lime and 30% less than magnesia).

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Pollution	Magnesium Oxides	Pollution Control	13B	
Flue Gases	Slurries	Stationary Sources	21B	11G
Desulfurization	Scrubbers		07A, 07D	13I
Sulfur Oxides			07B	
Calcium Carbonates				
Calcium Oxides				

18. DISTRIBUTION STATEMENT Release to Public	19. SECURITY CLASS *(This Report)* Unclassified	21. NO. OF PAGES 325
	20. SECURITY CLASS *(This page)* Unclassified	22. PRICE

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TECHNICAL REPORT DATA
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1. REPORT NO. EPA-600/7-80-002	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Control Assay Development: Methodology and Laboratory Verification		5. REPORT DATE January 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) W. F. Longaker, S. M. Hossain, and A. B. Cherry		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Catalytic, Inc. 1500 Market Street Philadelphia, Pennsylvania 19102		10. PROGRAM ELEMENT NO. EHE623A
		11. CONTRACT/GRANT NO. 68-02-2167, Tasks 9 and 12
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Task Final; 7/78 - 7/79
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is Robert A. McAllister, Mail Drop 61, 919/541-2160.

16. ABSTRACT The report describes Control Assay Development (CAD), a data acquisition program designed to evaluate the potential applicability of various treatment processes for the control of solid, liquid, and gaseous emissions from coal conversion plants. The CAD program described could be used to provide data for evaluating selected treatment technologies for coal conversion wastewaters. Detailed descriptions of all CAD screening procedures and equipment required for outfitting a mobile laboratory are presented. Laboratory tests were conducted to assess the adequacy of the proposed designs and operating procedures, and to verify the use of a dry bacterial culture for biological oxidation studies. A number of design modifications were recommended, based on the laboratory tests. Insufficient benefit is derived from the use of a dry bacterial culture during the bio-oxidation screening procedure to warrant its adoption in the testing procedure.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Pollution	Pollution Control	13B 07B,07C
Oxidation	Stationary Sources	14B
Assaying	Control Assay Development	08G,21D
Coal		13H
Coal Gasification	Biological Oxidation	
Waste Water	Coal Conversion	06C
Biology		

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	20. SECURITY CLASS *(This page)* Unclassified	22. PRICE

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TECHNICAL REPORT DATA
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1. REPORT NO. EPA-600/7-80-015b	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Experimental/Engineering Support for EPA's FBC Program: Final Report--Volume 2. Particulate, Nitrogen Oxide, and Trace Element Control		5. REPORT DATE January 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) D. F. Ciliberti, M. M. Ahmed, N. H. Ulerich, M. A. Alvin, and D. L. Keairns		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Westinghouse Research and Development Center 1310 Beulah Road Pittsburgh, Pennsylvania 15235		10. PROGRAM ELEMENT NO. INE825
		11. CONTRACT/GRANT NO. 68-02-2132
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Final; 12/75 - 12/78
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is D. Bruce Henschel, Mail Drop 61, 919/541-2825. EPA-600/7-78-050 also relates to this work.

16. ABSTRACT The report gives results of an investigation of particulate, NOx, and trace element control for atmospheric and pressurized fluidized-bed combustion (FBC) systems used with coal. A model, developed previously to project the loading and size distribution of particulate emissions from FBC systems, was used to permit an integrated analysis of particle control options for FBC. An experimental 150 scf/sec high-temperature/-pressure particulate control test facility, treating simulated flue gas, was constructed and shaken down to permit investigation of alternative particulate control devices. Available data on NOx emissions from FBC, and on NOx formation and decomposition, are reviewed to identify significant FBC operating parameters affecting NOx emissions, and to assess formation/decomposition mechanisms that may be controlling in FBC. The previous thermodynamic projections of trace element emissions from FBC were expanded to include aluminum, iron, titanium, cobalt, chromium, manganese, molybdenum, and nickel. These projections provide a first-level approximation of the distribution of volatile and condensed phases of compounds of these metals in FBC effluent streams.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Pollution Metals	Pollution Control	13B
Combustion	Stationary Sources	21B
Fluidized Bed Processing	Particulate	13H,07A
Coal	Trace Metals	21D
Dust		11G
Nitrogen Oxides		07B

18. DISTRIBUTION STATEMENT Release to Public	19. SECURITY CLASS *(This Report)* Unclassified	21. NO. OF PAGES 180
	20. SECURITY CLASS *(This page)* Unclassified	22. PRICE

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TECHNICAL REPORT DATA
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1. REPORT NO. EPA-600/7-80-029b	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE EPA Utility FGD Survey: January-March 1980		5. REPORT DATE May 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) M. Smith, M. Melia, and N. Gregory		8. PERFORMING ORGANIZATION REPORT NO. PN 3570-1-Z
9. PERFORMING ORGANIZATION NAME AND ADDRESS PEDCo Environmental, Inc. 11499 Chester Road Cincinnati, Ohio 45246		10. PROGRAM ELEMENT NO. INE828
		11. CONTRACT/GRANT NO. 68-01-4147, Task 143
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Quarterly; 1-3/80
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is Norman Kaplan, Mail Drop 61, 919/541-2556. The report supplements report EPA-600/7-80-029a.

16. ABSTRACT The report is the first of three supplements updating the October-December 1979 report (EPA-600/7-80-029a) and should be used in conjunction with it. The report, generated by a computerized data base system, presents a survey of operational and planned domestic utility flue gas desulfurization (FGD) systems, operational domestic particle scrubbers, and Japanese coal-fired utility boiler FGD installations. It summarizes information contributed by the utility industry, process suppliers, regulatory agencies, and consulting engineering firms. Domestic FGD systems are tabulated alphabetically by development status (operational, under construction, or in planning stages), utility company, process supplier, process, and waste disposal practice. It presents data on boiler design, FGD system design, fuel characteristics, and actual performance. It includes unit by unit dependability parameters and discusses problems and solutions associated with the boilers and FGD systems. Process flow diagrams and FGD system economic data are appended.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Pollution	Pollution Control	13B
Maintenance		
Flue Gases	Stationary Sources	21B
Desulfurization	Utility Boilers	07A, 07D
Electric Utilities		
Waste Disposal		15E
Boilers		13A

18. DISTRIBUTION STATEMENT Release to Public	19. SECURITY CLASS (This Report) Unclassified	21. NO. OF PAGES 258
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TECHNICAL REPORT DATA
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1. REPORT NO. EPA-600/7-80-034	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE A Mathematical Model of Electrostatic Precipitation (Revision 2)		5. REPORT DATE February 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) R. B. Mosley, M. H. Anderson, and J. R. McDonald		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Southern Research Institute 2000 Ninth Avenue, South Birmingham, Alabama 35205		10. PROGRAM ELEMENT NO. EHE624
		11. CONTRACT/GRANT NO. 68-02-2193
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Update; 1/76 - 12/78
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is Leslie E. Sparks, Mail Drop 61, 919/541-2925. This document augments, but does not replace, EPA-600/7-78-111a.

16. ABSTRACT The report describes modifications to the EPA/Southern Research Institute computer model of electrostatic precipitation (ESP). The modifications include a new semi-empirical approximation procedure for predicting electrical conditions in an ESP. Comparisons between the results from the approximation procedure and more exact procedures are presented. A new integration procedure for calculating particle charge is also presented. Complete FORTRAN listings of the revised ESP model and the new subprograms are provided. Example problems are included. The modified model requires significantly less computer time than does the earlier model. Comparisons of results obtained using the earlier and the modified models over a wide range of possible ESP geometries and electrical operating points indicate that for practical purposes the modified model can be used in place of the more rigorous earlier model.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Pollution	Pollution Control	13B
Electrostatic Precipitation	Stationary Sources	13H
Mathematical Models		12A
FORTRAN		09B

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TECHNICAL REPORT DATA
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1. REPORT NO. EPA-600/7-80-041	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Multimedia Environmental Goals for Environmental Assessment, Volume I (Supplement A)		5. REPORT DATE March 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) G. L. Kingsbury, J. B. White, and J. S. Watson		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Research Triangle Institute P.O. Box 12194 Research Triangle Park, North Carolina 27709		10. PROGRAM ELEMENT NO. EHE623A
		11. CONTRACT/GRANT NO. 68-02-3132, Task 4
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Supplement; 10/78-10/79
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is N. Dean Smith, Mail Drop 61, 919/541-2708. EPA-600/7-77-136a and -136b and EPA-600/7-79-176a and -176b are related Volumes I, II, III, and IV.

16. ABSTRACT The report supplements Volume I (EPA-600/7-77-136a) of the two-volume 1977 EPA report that introduced a methodology to establish Multimedia Environmental Goals (MEGs) for chemical pollutants. It summarizes the original methodology and introduces minor improvements. Improvements include the assignment of a unique identification number to each MEG compound and modification of the original model used to derive MEG values for land or solid waste. Its appendices include: revised category descriptions, an updated master list of organic compounds, a candidate list of compounds to be considered for future MEGs, tabulated discharge MEG values, and hazard potential values. It also includes graphical summaries of MEGs for 586 organic chemicals. The Supplement is to be used in coordination with MEG Volumes III and IV (EPA-600/7-79-176a and -176b) which contain background information summaries and MEG charts for organic compounds in the new MEGs master list.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Pollution Environmental Engineering Assessments	Pollution Control Stationary Sources Multimedia Environmental Goals (MEGs) Environmental Assessment	13B 05E 14B

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TECHNICAL REPORT DATA
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1. REPORT NO. EPA-600/7-80-047	2. NTIS PB 80-187966	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Feasibility of Recovering Useful Salts from Irrigation Wastewater Concentrates Produced by Power Plant Cooling		5. REPORT DATE March 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Hugo H. Sephton		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS The University of California Sea Water Conversion Laboratory 47th and Huffman Boulevard Richmond, California 94804		10. PROGRAM ELEMENT NO. INE827
		11. CONTRACT/GRANT NO. Grant R804760
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Final; 10/76 - 12/79
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is Theodore G. Brna, Mail Drop 61, 919/541-2683.

16. ABSTRACT The report evaluates the feasibility of a novel energy-conserving way to recover useful salts (sodium sulfate and calcium sulfate) from concentrated brines by evaporation/crystallization. The concentrated brines examined were cooling tower blowdown from agricultural wastewater and this blowdown after further concentration and use in ion exchange regeneration. Laboratory and pilot tests were made with both conventional evaporation/crystallization and interface-enhanced, vertical-tube foam evaporation which increases evaporation. Sodium sulfate and calcium sulfate recovery provides potential capital cost savings, about $2 million for a 1000-MWe power plant. Sale of these products is an added incentive to their recovery. The use of foamy vapor/liquid flow on the evaporating brine/crystal slurry enhanced heat transfer by up to 40% and enabled concurrent energy reductions of 28%, compared to conventional evaporation/crystallization of sodium sulfate in a 5000-gpd vapor-compression vertical-tube evaporation pilot plant. Consequently, the use of agricultural wastewater for power plant cooling in the San Joaquin Valley with ion exchange for pre-softening and wastewater regeneration solely with concentrated brine from blowdown appears technically feasible and economically attractive.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Pollution	Sodium Sulfates	Pollution Control	13B	07B
Waste Water	Calcium Sulfates	Stationary Sources		
Industrial Water	Brines			11G
Agricultural Wastes			02A	
Irrigation	Evaporation		02C	07D
Cooling Water	Crystallization		13A	

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TECHNICAL REPORT DATA
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1. REPORT NO. EPA-600/7-80-051	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Stack Gas Reheat Evaluation		5. REPORT DATE March 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) W.R. Menzies, C.A. Muela, and G.P. Behrens		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Radian Corporation, 8500 Shoal Creek Boulevard, Austin, Texas 78766		10. PROGRAM ELEMENT NO. INE827
		11. CONTRACT/GRANT NO. 68-02-2642
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development, Industrial Environmental Research Laboratory, Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Final; 6/77-2/80
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is Theodore G. Brna, Mail Drop 61, 919/541-2683.

16. ABSTRACT The report gives results of technical and economic evaluations of stack gas reheat (SGR) following wet flue gas desulfurization (FGD) for coal-fired power plants. The evaluations were based on information from literature and a survey of FGD users, vendors, and architect/engineer (A/E) firms. The report summarizes SGR processes and their features and their commercial operating experience. It addresses benefits and energy requirements associated with SGR, and describes a developed method for estimating reheat costs. SGR can protect equipment downstream of a wet scrubber from corrosion, reduce the potential for acid rainout near the plant stack, preclude visible stack plumes, and reduce ground-level pollutant concentrations by increasing plume buoyancy. SGR users have generally installed it for equipment protection (30 F or higher reheat is normally specified). Most A/E firms and vendors do not recommend SGR as a necessary part of a wet FGD system; they prefer the higher reliability of indirect hot air injection. Plants slated for operation with wet scrubbers in 1983 will use inline (30%), bypass (24%), and indirect hot air (14%) reheat or no reheat (wet stacks, 20%). Inline reheat is generally less costly but has lower reliability than indirect hot air reheat. Bypass reheat is the most economical; but its application is limited by SO2 emission regulations.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Pollution	Pollution Control	13B
Desulfurization	Stationary Sources	07A, 07D
Flue Gases	Stack Gas Reheat	21B
Reheating		13A
Coal		21D
Combustion		
Evaluation		14B

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TECHNICAL REPORT DATA
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1. REPORT NO. EPA-600/7-80-052	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Evaluation of Lime Precipitation for Treating Boiler Tube Cleaning Wastes		5. REPORT DATE March 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) P.J. Rogoshewski and D.D. Carstea		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Hittman Associates, Inc. 9190 Red Branch Road Columbia, Maryland 21045		10. PROGRAM ELEMENT NO. INE624A
		11. CONTRACT/GRANT NO. 68-02-2684
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Final; 4/78-12/79
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is Julian W. Jones, Mail Drop 61, 919/541-2489.

16. ABSTRACT The report gives results of an evaluation of lime precipitation for treating boiler tube cleaning wastes. In this project, wastewater samples were collected from six boiler tubeside chemical cleanings, using complexing and chelating agents. The samples represented: (1) ammoniacal bromate/hydrochloric acid, (2) thiourea-hydrochloric acid, (3) hydroxyacetic-formic acid, (4) ammoniated citric acid, and (5) ammoniated EDTA cleaning systems. Wastewater samples were also collected from boiler fireside and air preheater washes. A treatment methodology was investigated that involved: dilution of the boiler tubeside cleaning wastewater with a mixture of the fireside and air preheater wash wastewaters, precipitation with lime, and addition of polymers for clarification. After settling of the solids, the supernatant was analyzed for total and dissolved iron, copper, nickel, zinc, and total suspended solids. Major variations in testing included adjustments in pH and dilution ratio. Results indicate that, on a bench scale, the treatment methodology effectively reduced the concentration of iron, copper, and zinc in the tubeside cleaning wastewater to < 1 mg/l. Attainable nickel residuals were also < 1 mg/l for wastes from all except the ammoniated EDTA system, for which nickel residuals were not < 5 mg/l.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Pollution	Precipitation	Pollution Control	13B	07D
Boiler Tubes	Evaluation	Stationary Sources	13A	14B
Chemical Cleaning	Complex Compounds		13H, 07A	07C
Waste Water	Chelation			
Waste Treatment	Polymers			
Calcium Oxides			07B	

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TECHNICAL REPORT DATA
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1. REPORT NO. EPA-600/7-80-062	2. NTIS PB 80-187420	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Review of Concurrent Mass Emission and Opacity Measurements for Coal-burning Utility and Industrial Boilers		5. REPORT DATE March 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) R. J. Brennan, Richard Dennis, and D. R. Roeck		8. PERFORMING ORGANIZATION REPORT NO. GCA-TR-80-3-G
9. PERFORMING ORGANIZATION NAME AND ADDRESS GCA Technology Division Burlington Road Bedford, Massachusetts 01730		10. PROGRAM ELEMENT NO. INE830
		11. CONTRACT/GRANT NO. 68-02-2607, Task 19
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Final; 8/79-2/80
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is James H. Turner, Mail Drop 61, 919/541-2925.

16. ABSTRACT The report gives results of concurrent particulate emissions and opacity measurements based on visual observations and/or in-stack transmissometry for more than 400 compliance, acceptance, or experimental tests on coal-fired utility and industrial boilers. The sampling, which includes a capacity range of a few to several hundred megawatts and typical firing methods (pulverized, stoker, and cyclone), in most cases reflects flyash control by electrostatic precipitation, although filters or mechanical collectors were used at a few installations. All opacity measurements were standardized to their equivalent values for a 4 m (13.0 ft) diameter stack before being compared with their corresponding particulate emissions, the latter expressed as actual grams per cubic meter. No discernible correlations applicable to all sources were observed, although some modest (but apparently significant) correlations were noted on an individual source basis. Thus, any useful and definitive relationships between particulate mass emission rates and their corresponding opacity levels appear to be site specific. Furthermore, correlations with transmissometer measurements were far stronger than those derived from visual estimates of opacity. Report findings were sufficiently encouraging to warrant furthur analyses relating to in-stack transmissometer measurements.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Pollution	Dust	Pollution Control	13B	11G
Coal	Aerosols	Stationary Sources	21D	07D
Combustion	Boilers	Mass Emissions	21B	13A
Measurements	Transmissometers	Particulate	14B	
Opacity		Particulate Mass Emissions		
Emission				

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	20. SECURITY CLASS *(This page)* Unclassified	22. PRICE

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1. REPORT NO. EPA-600/7-80-064b	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Field Tests of Industrial Stoker Coal-fired Boilers for Emissions Control and Efficiency Improvement--Site E (Data Supplement)		5. REPORT DATE April 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) J.O. Burlingame, R.A. Parker, W.M. Jackson, and J.D. Demont		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS KVB, Inc. 6176 Olson Memorial Highway Minneapolis, Minnesota 55422		10. PROGRAM ELEMENT NO. EHE624
		11. CONTRACT/GRANT NO. EPA-IAG-D7-E681 and DOE-EF-77-C-01-2609
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development * Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Supplement; 11/78-1/79
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES (*)Cosponsors are DOE and American Boiler Manufacturers Assoc. Project officers are R. Hall (EPA) and W. Harvey Jr. (DOE). The final technical report is EPA-600/7-80-064a.

16. ABSTRACT The Data Supplement is a compilation of test data presented in greater detail than was practical in the final technical report. It is intended to provide the necessary details to other researchers who are interested in performing their own analysis. Readers are referred to the contract final report for information as to objectives, description of facility tested and coals fired, test equipment and procedures, interpretations, and conclusions. The final technical report also contains data summaries not found in this supplement. The Supplement contains panel board data for each test, detailed particulate, O2, CO2, NO, SO2, and SO3 data, particle size distribution data, modified smoke spot data, chemical analysis of the coal, and coal size consistency data.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Air Pollution	Improvement	Air Pollution Control	13B	
Boilers	Efficiency	Stationary Sources	13A	
Combustion	Flue Gases	Combustion Modification	21B	
Coal	Fly Ash	Spreader Stokers	21D	
Field Tests	Particle Size	Particulate	14B	
Dust	Nitrogen Oxides	Overfire Air	11G	07B
Stokers	Sulfur Oxides	Flyash Reinjection		

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	20. SECURITY CLASS *(This page)* Unclassified	22. PRICE

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TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA-600/7-80-076	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE High Resistivity Behavior of Hot-side Electrostatic Precipitators		5. REPORT DATE April 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Roy E. Bickelhaupt		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Southern Research Institute, 2000 Ninth Avenue, South, Birmingham, Alabama 35205		10. PROGRAM ELEMENT NO. EHE624
		11. CONTRACT/GRANT NO. 68-02-2610, Task 10
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development, Industrial Environmental Research Laboratory, Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Task Final; 10/78-10/79
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is Leslie E. Sparks, Mail Drop 61, 919/541-2925.

16. ABSTRACT The report gives results of experiments to explain the high resistivity behavior of hot-side electrostatic precipitators (ESPs) collecting fly ash. The working hypothesis is that the behavior is the result of the buildup of a thin layer of sodium-ion-depleted fly ash which has a high electrical resistivity near the collector plate. The hypothesis was tested by experiments in a miniature corona discharge device under thermal and environmental conditions simulating a hot-side ESP. Current density-voltage curves were taken with positive-negative corona using a hand-placed ash layer 5 mm thick. Three major experiments were conducted to evaluate the effect on current density-voltage relationships of: long exposure to negative corona, long exposure to positive corona, and cyclic exposure to negative and positive corona. Exposure of a stationary ash layer to continuously applied negative or positive corona degraded the current density-voltage relationship. All evidence suggests that the examined hypothesis is correct. The data also indicate that some form of reversible polarity corona could remedy the difficulty. Improved rapping (to eliminate the thin adherent ash layer) or development of a suitable conditioning agent (with respect to resistivity attenuation or ash rapping and reentrainment) would be desirable.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Pollution	Pollution Control	13B	13H
Cleaning	Stationary Sources	13I	
Electrostatic Precipitators	Particulate	20C	
Electrical Resistivity	Conditioning	21B	14B
Fly Ash	Rapping	11G	
Treatment			
Dust			
Electric Corona			

18. DISTRIBUTION STATEMENT Release to Public	19. SECURITY CLASS *(This Report)* Unclassified	21. NO. OF PAGES 36
	20. SECURITY CLASS *(This page)* Unclassified	22. PRICE

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TECHNICAL REPORT DATA
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1. REPORT NO. EPA-600/7-80-078	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Wet/Dry Cooling Tower Test Module		5. REPORT DATE April 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) D.M. Burkart		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Southern California Edison Company P.O. Box 800 Rosemead, California 91770		10. PROGRAM ELEMENT NO. INE624
		11. CONTRACT/GRANT NO. Grant No. R805220
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Final; 8/77-7/79
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is Theodore G. Brna, Mail Drop 61, 919/541-2683.

16. ABSTRACT The report gives results of an evaluation of the engineering performance of a single-cell wet/dry cooling tower (about 25 MW) in an 18-month field test at San Bernardino, CA. Test objectives included determination of the water conservation and operating characteristics, and verification of a mathematical model for the wet/dry cooling tower. The crossflow tower had parallel air flows through the wet and dry sections, and dampers which regulated air flow to allow cooling in either section, or any combination of the two. Without significantly affecting normal plant performance, the wet/dry cooling tower could save about 19% of the water normally evaporated annually by an all-wet tower at the test site. Greater savings could have been achieved by accepting some loss of plant efficiency during the winter months. The mathematical model developed for the tower was verified by test results. Although some operational problems developed during testing, the major goals of the test program were achieved.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Pollution	Pollution Control	13B
Cooling Towers	Stationary Sources	13A, 07A, 13I
Testing	Wet/Dry Cooling	14B
Water Conservation	Operating Characteristics	
Characteristics		
Mathematical Models		12A

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	20. SECURITY CLASS (This page) Unclassified	22. PRICE

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TECHNICAL REPORT DATA
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1. REPORT NO. EPA-600/7-80-085b	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Thirty-day Field Tests of Industrial Boilers: Site 2--Residual-oil-fired Boiler		5. REPORT DATE April 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) W.A. Carter and R.J. Tidona		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS KVB, Inc. P.O. Box 19618 Irvine, California 92714		10. PROGRAM ELEMENT NO. EHE624
		11. CONTRACT/GRANT NO. 68-02-2645, Task 4
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Task Final; 3/79-3/80
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is Robert E. Hall, Mail Drop 65, 919/541-2477.

16. ABSTRACT This report is a final one for a test program to evaluate the long-term effectiveness of combustion modifications on industrial boilers. Previous short-term tests had been performed on industrial boilers to determine the effect of combustion modifications on such air pollutant emissions as NOx, SOx, CO, HC, and particulate. The objective of this program was to determine if the combustion modification techniques which were effective for the short-term tests are feasible for longer periods. The report gives results of a 30-day field test of a 26.4 MW output (90,000 lb steam/hr) residual-oil-fired boiler using staged combustion air and low excess air to control NOx emissions. Results indicate that these combustion modifications are effective long-term NOx controls for this type of residual-oil-fired boiler. The as-found NOx concentration was 158 ng/J (281 ppm at 3% O2, dry). With staged combustion and low excess air firing, the mean NOx emission level was 110 ng/J (196 ppm at 3% O2, dry). Boiler efficiency increased by 0.7% under low NOx firing conditions.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Pollution	Carbon Monoxide	Pollution Control	13B	
Boilers	Hydrocarbons	Stationary Sources	13A	07C
Residual Oils	Dust	Industrial Boilers	21D	11G
Combustion		Combustion Modification	21B	
Field Tests		Staged Combustion	14B	
Sulfur Oxides		Low Excess Air	07B	
Nitrogen Oxides		Particulate		

18. DISTRIBUTION STATEMENT Release to Public	19. SECURITY CLASS *(This Report)* Unclassified	21. NO. OF PAGES 192
	20. SECURITY CLASS *(This page)* Unclassified	22. PRICE

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TECHNICAL REPORT DATA
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1. REPORT NO. EPA-600/7-80-085c	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Thirty-day Field Tests of Industrial Boilers: Site 3--Pulverized-coal-fired Boiler		5. REPORT DATE April 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) W.A. Carter and H.J. Buening		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS KVB, Inc. P.O. Box 19518 Irvine, California 92714		10. PROGRAM ELEMENT NO. EHE624
		11. CONTRACT/GRANT NO. 68-02-2645, Task 4
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Task Final; 3/79-3/80
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is Robert E. Hall, Mail Drop 65, 919/541-2477.

16. ABSTRACT This is a final report for a test program to evaluate the long-term effectiveness of combustion modifications for lowering emissions from industrial boilers. Previous short-term tests had been performed on industrial boilers to determine the effect of combustion modifications on such air pollutant emissions as NOx, SOx, CO, HC, and particulate. The objective of this program was to determine if the combustion modification techniques which were effective for the short-term tests are feasible for longer periods. The report gives results of a 30-day field test of a pulverized-coal-fired, water-tube boiler rated at 76.2 MW (260,000 lb steam/hr) output. Staged combustion air and low excess air were used to effectively control NOx emissions. However, such additional operational problems as flame instability can be encountered. The baseline NO measurement was 498 ng/J (815 ppm at 3% O2, dry) with the unit operating at about 70% of capacity. At the same load, low NOx operations yielded NO at an emission level of 422 ng/J (691 ppm at 3% O2, dry) for a 15% NO reduction. During 30 days of firing under low NOx operation with loads of 15 to 63 MW, the average NO emission level was 340 ng/J (557 ppm at 3% O2, dry). Boiler efficiency increased about 1% under low NOx firing conditions.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Pollution	Nitrogen Oxides	Pollution Control	13B	
Boilers	Carbon Monoxide	Stationary Sources	13A	
Pulverized Fuels	Hydrocarbons	Industrial Boilers	21D	07C
Coal	Dust	Combustion Modification		11G
Combustion		Staged Combustion	21B	
Field Tests		Low Excess Air	14B	
Sulfur Oxides		Particulate	07B	

18. DISTRIBUTION STATEMENT Release to Public	19. SECURITY CLASS (This Report) Unclassified	21. NO. OF PAGES 161
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1. REPORT NO. EPA-600/7-80-085d	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Thirty-day Field Tests of Industrial Boilers: Site 4--Coal-fired Spreader Stoker		5. REPORT DATE April 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) W.A. Carter and J.R. Hart		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS KVB, Inc. P.O. Box 19518 Irvine, California 92714		10. PROGRAM ELEMENT NO. EHE624
		11. CONTRACT/GRANT NO. 68-02-2645, Task 4
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Task Final; 3/79-3/80
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is Robert E. Hall, Mail Drop 65, 919/541-2477.

16. ABSTRACT This is a final report for a test program to evaluate the long-term effectiveness of combustion modifications on industrial boilers. Previous short-term tests had been performed on industrial boilers to determine the effect of combustion modifications on such air pollutant emissions as NOx, SOx, CO, HC, and particulate. The objective of this program was to determine if the combustion modification techniques which were effective for the short-term tests are feasible for longer periods. The report gives results of a 30-day field test of a 38.1 MW (130,000 lb steam/hr) output coal-fired spreader stoker. Low excess air was used to control NOx emissions. Results indicate that low excess air firing is an effective long-term NOx control for spreader stokers. The as-found NOx concentration was 240 ng/J (409 ppm at 3% O2, dry) with the boiler load at 80% of design capacity. Firing in the low excess air mode reduced the as-found condition by about 19%. Low excess air firing also increased efficiency by about 1.2% and decreased particulates by about 22%.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Pollution	Nitrogen Oxides	Pollution Control	13B	
Boilers	Carbon Monoxide	Stationary Sources	13A	
Coal	Hydrocarbons	Industrial Boilers	21D	07C
Combustion	Dust	Combustion Modification	21B	11G
Field Tests		Spreader Stokers	14B	
Stokers		Low Excess Air		
Sulfur Oxides		Particulate	07B	

18. DISTRIBUTION STATEMENT Release to Public	19. SECURITY CLASS *(This Report)* Unclassified	21. NO. OF PAGES 175
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1. REPORT NO. EPA-600/7-80-086	2. NTIS PB 80-187735	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Environmental Assessment of a Coal-fired Controlled Utility Boiler		5. REPORT DATE April 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) C. Leavitt, K. Arledge, C. Shih, R. Orsini, A. Saur, W. Hamersma, R. Maddalone, R. Beimer, G. Richard, S. Unges, and M. Yamada		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS TRW, Inc. One Space Park Redondo Beach, California 90278		10. PROGRAM ELEMENT NO. EHE624A
		11. CONTRACT/GRANT NO. 68-02-2613, Task 8
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Task Final; 6/78-12/79
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is Michael C. Osborne, Mail Drop 62, 919/541-3996.

16. ABSTRACT The report gives results of a comprehensive multimedia emissions assessment of the cyclone-fired La Cygne No. 1 boiler, equipped with SO2 and particulate emission controls. Levels 1 and 2 procedures were used to characterize pollutant emissions in gaseous, liquid, and solid process streams. Assessment results, in conjunction with assumed typical and worst case meteorological conditions, were used to estimate the environmental impact of emissions from this type of unit. Principal conclusions were: (1) The risk of violating NAAQS for 24 hour and annual average levels is low; however, units using high sulfur fuel may exceed short term NAAQS for SO2. (2) Little adverse health effect is anticipated as a result of SO2, SO4 (--), and particulate emissions projected from widespread use of coal-fired units of the type tested. (3) Increases in the concentrations of Cd and Pb in soil and plant tissue as a result of trace element emissions could damage plants and adversely affect the health of animals consuming vegetation in the affected areas. (4) Plants may be damaged by NOx emissions since estimated NOx concentrations approach or exceed threshold concentrations. (5) Sensitive plant species may be damaged by predicted short-term SO2 concentrations which are in the damage threshold range.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Pollution	Dust	Pollution Control	13B	11G
Assessments	Nitrogen Oxides	Stationary Sources	14B	
Boilers	Cadmium	Environmental Assessment	13A	
Coal	Lead		21D	
Combustion		Utility Boilers	21B	
Sulfur Oxides		Particulate	07B	

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TECHNICAL REPORT DATA
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1. REPORT NO. EPA-600/7-80-087	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Environmental Assessment of an Oil-fired Controlled Utility Boiler		5. REPORT DATE April 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) C. Leavitt, K. Arledge, C. Shih, R. Orsini, A. Saur, W. Hamersma, R. Maddalone, R. Beimer, G. Richard, S. Unges, and M. Yamada		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS TRW, Inc. One Space Park Redondo Beach, California 90278		10. PROGRAM ELEMENT NO. EHE624A
		11. CONTRACT/GRANT NO. 68-02-2613, Task 8
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Task Final; 6/78-12/79
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is Michael C. Osborne, Mail Drop 62, 919/541-3996.

16. ABSTRACT The report gives results of a comprehensive emissions assessment of the Haynes No. 5 boiler during oil-firing. Levels 1 and 2 procedures were used to characterize pollutant emissions. Assessment results, in conjunction with assumed typical and worst case meteorological conditions, were used to estimate the environmental impact of emissions from this type of unit. Principal conclusions were: (1) The risk of violating NAAQS due to criteria pollutant emissions is low. (2) Little adverse health effect is anticipated as a result of SO2, SO4 (--), and particulate emissions projected from widespread use of oil-fired units of the type tested. (3) The impact of trace element burdens in drinking water, plant tissue, soil, and the atmosphere is negligible. (4) The risk of plant damage due to criteria pollutant emissions is remote. (5) The likelihood of plant damage due to trace element emissions is remote.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Pollution	Dust	Pollution Control	13B	11G
Assessments		Stationary Sources	14B	
Boilers		Environmental Assessment	13A	
Fuel Oil			21D	
Combustion		Utility Boilers	21B	
Sulfur Oxides		Particulate	07B	

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TECHNICAL REPORT DATA
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1. REPORT NO. EPA-600/7-80-091	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Investigation of CARS and Laser-induced Saturated Fluorescence for Practical Combustion Diagnosis		5. REPORT DATE May 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) A. C. Eckbreth, P. A. Bonczyk, and J. F. Verdieck		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS United Technologies Research Center East Hartford, Connecticut 06108		10. PROGRAM ELEMENT NO. INE623
		11. CONTRACT/GRANT NO. 68-02-3105
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Final; 8/78-8/79
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is William B. Kuykendal, Mail Drop 62, 919/541-2557. EPA-600/7-77-066 and EPA-600/7-78-104 are related reports.

16. ABSTRACT The report gives results of experimental investigations aimed at developing nonperturbing, spatially precise, in-situ diagnostic techniques to measure species composition and temperature in flames. The investigations continued earlier development of coherent anti-Stokes Raman spectroscopy (CARS) and laser-induced saturated fluorescence. The program included two main, concurrent tasks. In Task 1, optical thermometry, the practical feasibility of CARS was demonstrated in a program of research-scale combustor testing (results agreed to within 5% for combustion zone temperature measurements made with CARS and with shielded thermocouples). In Task 2, optical composition, laser-induced saturated fluorescence was examined in regard to its capability for measuring CH, CN, and NO concentrations in flames. Saturation of the fluorescence in CH and CN was achieved and considerable insight into the physics of saturated fluorescence was obtained. Promising initial results of NO fluorescence in flames are described, but saturation was not observed for laser spectral intensities up to 6 million W/sq cm/cm.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Pollution	Spectroscopy	Pollution Control	13B	
Combustion	Fluorescence	Stationary Sources	21B	20F
Flames	Lasers	Optical Composition		20E
Measurement		Optical Thermometry	14B	
Optical Tests		CARS		
Temperature				

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1. REPORT NO. EPA-600/7-80-092	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Fine Particle Emissions Information System: Annual Report (1979)		5. REPORT DATE May 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) J. P. Reider and R. F. Hegarty		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Midwest Research Institute, 425 Volker Boulevard, Kansas City, Missouri 64110		10. PROGRAM ELEMENT NO. EHE624A
		11. CONTRACT/GRANT NO. 68-02-2641
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development, Industrial Environmental Research Laboratory, Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Annual; 1-12/79
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is Gary L. Johnson, Mail Drop 63, 919/541-2745. EPA-600/7-79-126 was the 1978 annual report.

16. ABSTRACT The report is the second annual report on the Fine Particle Emissions Information System (FPEIS), a computerized data base on primary fine particle emissions from stationary sources. The report summarizes new data added to the FPEIS during 1979 and outlines objectives for 1980 including the emergence of the Environmental Assessment Data Systems (EADS). The FPEIS provides a centralized inventory of fine particle measurement information for researchers engaged in fine particle control technology development and in the environmental assessment of energy and industrial processes. The first (1978) annual report on FPEIS reported 120 test sites in the data base. By the end of 1979, 47 new test sites had been added to the data base and the total of sampling runs had increased to over 2800.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Pollution	Computer Systems	Pollution Control	13B	
Dust	Programs	Stationary Sources	11G	09B
Emission	Bioassay	Particulate	14B	06A
Assessments	Radiology	Fine Particle Emissions		06E
Industrial Processes		Information System	13H	
Energy Conversion Techniques		Environmental Assess-	10A	
Chemical Analysis		ment	07D	

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1. REPORT NO. EPA-600/7-80-095	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Generation and Attenuation of Leachate from Fluidized-bed Combustion Solid Wastes: First Year Progress Report		5. REPORT DATE May 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) T. W. Grimshaw, D. N. Garner, W. F. Holland, A. G. Lamkin, W. M. Little, R. M. Mann, and H. J. Williamson		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Radian Corporation 8500 Shoal Creek Boulevard Austin, Texas 78766		10. PROGRAM ELEMENT NO. INE825
		11. CONTRACT/GRANT NO. 68-02-3103
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Annual; 8/78-11/79
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is David A. Kirchgessner, Mail Drop 61, 919/541-2825.

16. ABSTRACT The report gives results of a study of the environmental effects of improperly disposing of fluidized-bed combustion (FBC) residues. It includes: an analysis of representative FBC residues and their interaction with natural environmental media; and development of a method of ensuring environmental protection from the impacts of FBC wastes on a case-by-case basis. Residues from pressurized FBC and their interaction with six representative disposal media were studied. It gives detailed results of laboratory and field studies of leachate generation and attenuation for Ca, B, and SO4. More cursory examination of these parameters and 17 others was conducted by comparing volume-weighted averages of leachate concentrations with primary and secondary drinking water standards, Multimedia Environmental Goals (MEGs), and Quality Criteria for Water (QCW). With respect to drinking water standards, the parameters of greatest concern are Cd, Mn, SO4, and total dissolved solids. For the MEGs, Ca, Cd, Co, Ni, K, Ag, and Mn are all of concern. Only Bo is considered of special concern with respect to QCW. The six disposal media were sandstone, shale, alluvium, glacial till, limestone, and interburden. The investigations included a multistep laboratory protocol for leachate generation from FBC wastes and subsequent attenuation of the leachate by the disposal media.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Pollution	Pollution Control	13B
Combustion	Stationary Sources	21B
Fluidized Bed Processing		13H
Waste Disposal		
Leaching		07D,07A
Water Quality		
Boron		07B

18. DISTRIBUTION STATEMENT Release to Public	19. SECURITY CLASS *(This Report)* Unclassified	21. NO. OF PAGES 320
	20. SECURITY CLASS *(This page)* Unclassified	22. PRICE

EPA Form 2220-1 (9-73)

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA-600/7-80-097	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Environmental Assessment: Source Test and Evaluation Report--Wellman-Galusha (Ft. Snelling) Low-Btu Gasification		5. REPORT DATE May 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) M. P. Kilpatrick, R. A. Magee, T. E. Emmel, and G. C. Page		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Radian Corporation P.O. Box 9948 Austin, Texas 78766		10. PROGRAM ELEMENT NO. INE825
		11. CONTRACT/GRANT NO. 68-02-2147, Exhibit A
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Final; 9/78-12/79
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is William J. Rhodes, Mail Drop 61, 919/541-2851.

16. ABSTRACT The report gives results of a source test and evaluation of a Wellman-Galusha gasifier at the U.S. Bureau of Mines' Twin Cities Metallurgy Research Center at Ft. Snelling. The gasifier is operated as part of the Bureau's investigation of the use of low-Btu gas as a fuel for iron ore pelletizing. Program objectives were to provide survey data from which a preliminary assessment of potential environmental impact could be made, and to identify potential problems which would require further characterization or pollution control technology implementation. Difficulties with the test burner operation resulted in the product gas being vented to the startup flare, bypassing the cyclone during a majority of the lignite test (North Dakota, Indian Head), December 9-15, 1978. Therefore, data for the test burner is somewhat limited and the product gas characterization does not reflect the particulate removal capability of the process cyclone. Within these constraints, the test objectives were met. The Source Analysis Model/IA was used to provide rapid screening for identifying and prioritizing potentially harmful waste streams. Identified as major contributors to the overall health discharge severity were benzopyrene and CO in the product gas; and As and Cr in the test burner flue gas. Several gasifier-related water components exceeded Federal drinking water standards.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Pollution Toxicity	Pollution Control	13B 06T
Assessments	Stationary Sources	14B
Coal Gasification	Environmental Assessment	13H
Iron Ores		08G
Pelleting	Wellman-Galusha Process	07A
Lignite		21D
Dust	Particulate	11G

18. DISTRIBUTION STATEMENT Release to Public	19. SECURITY CLASS (This Report) Unclassified	21. NO. OF PAGES 606
	20. SECURITY CLASS (This page) Unclassified	22. PRICE

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TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA-600/7-80-099	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE A Demonstration of Beneficial Uses of Warm Water from Condensers of Electric Generating Plants		5. REPORT DATE May 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) L. L. Boyd (U. of MN), G. C. Ashley, J. S. Hietala, R. V. Stansfield, and T. R. C. Tonkinson		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Northern States Power Company. 414 Nicollet Mall Minneapolis, Minnesota 55401		10. PROGRAM ELEMENT NO. EHE624
		11. CONTRACT/GRANT NO. Grant S-803770
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Grant Final; 5/75-4/80
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is Theodore G. Brna, Mail Drop 61, 919/541-2683.

16. ABSTRACT

The report gives results of a project to demonstrate that warmed cooling water from condensers of electric generating plants can effectively and economically heat greenhouses. The 0.2-hectare demonstration greenhouse, at Northern States Power Co.'s Sherburne County (Sherco) Generating Plant, used 29.4 C water to heat both air and soil: finned-tube commercial heat exchangers were used to heat the air; and buried plastic pipes, the soil. Warm water from the Sherco 1 cooling tower was piped over 0.8 km to the greenhouse where it was cooled from 2.7 to 5.6 C before returning to the cooling tower basin. Roses and tomatoes were the principal crops in the 3-year test, although other flowers and vegetables, and conifer seedlings were also grown. The warm water heating system supplied all the greenhouse heating requirements, even at ambient temperatures as low as -40 C. Roses, snapdragons, geraniums, tomatoes, lettuce, and evergreen seedlings were grown successfully. The demonstration proved the concept to be both technically and economically feasible at Sherco, with an apparent saving of $4500/hectare in 1978 dollars over fuel oil heating, plus an annual oil savings of about 500 cu m/hectare. Privately financed commercial greenhouses heated with warm water were built at Sherco in 1977. The commercial greenhouses will expand from 0.48 to almost 1 hectare by late 1980.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Pollution	Softwoods	Pollution Control	13B	11L
Electric Power Plants	Seeds	Stationary Sources	10B	
Cooling Water		Conifers	13A	
Greenhouses		Seedlings	02C	
Heating			13H	
Vegetables			02D	
Flowers				

18. DISTRIBUTION STATEMENT Release to Public	19. SECURITY CLASS *(This Report)* Unclassified	21. NO. OF PAGES 73
	20. SECURITY CLASS *(This page)* Unclassified	22. PRICE

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TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA-600/7-80-112a	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Field Tests of Industrial Stoker Coal-fired Boilers for Emissions Control and Efficiency Improvement--Site H		5. REPORT DATE May 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) P. L. Langsjoen, R. J. Tidona, and J. E. Gabrielson		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS KVB, Inc. 6176 Olson Memorial Highway Minneapolis, Minnesota 55422		10. PROGRAM ELEMENT NO. EHE624
		11. CONTRACT/GRANT NO. IAG-D7-E681 (EPA) and EF-77-C-01-2609 (DoE)
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development* Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Final; 3/79-4/79
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is R. E. Hall. (*) Cosponsors are DoE (W. T. Harvey Jr.) and the American Boiler Manufacturers Assoc. EPA-600/7-78-136a,-79-041a,-130a,-147a,-80-064a,-065a, and -082a are Site A-G reports.

16. ABSTRACT The report gives test results on a coal-fired, overfeed, traveling-grate stoker. The boiler tested is rated at 45,000 lb/hr saturated steam at 140 psig. Measurements include gaseous emissions (O_2, CO_2, CO, NO, NO_2, SO_3, and HC), uncontrolled particulate mass loading, particle size distribution of the flyash, combustible content of the bottom ash and flyash, and boiler efficiency. Measurements were made at loads representing 50, 75, and 100% of design capacity, several excess air levels, and both high- and low-overfire air pressure settings. Increased overfire air pressures decreased particulate loading, CO, and HC. Particulate loading was 1.0 lb/million Btu under full-load high-overfire-air conditions. NOx averaged 0.416 lb/million Btu (307 ppm) at full load.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Air Pollution	Improvement	Air Pollution Control	13B	14G
Boilers	Efficiency	Stationary Sources	13A	
Combustion	Flue Gases	Combustion Modification	21B	
Coal	Fly Ash	Spreader Stokers	21D	
Field Tests	Particle Size	Traveling Grate Stokers	14B	
Dust	Nitrogen Oxides	Particulate	11G	07B
Stokers	Sulfur Oxides	Overfire Air		

18. DISTRIBUTION STATEMENT Release to Public	19. SECURITY CLASS *(This Report)* Unclassified	21. NO. OF PAGES 87
	20. SECURITY CLASS *(This page)* Unclassified	22. PRICE

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TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA-600/7-80-115	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE EPA Alkali Scrubbing Test Facility: Advanced Program--Final Report (October 1974-June 1978)		5. REPORT DATE May 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) D. A. Burbank and S. C. Wang		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Bechtel National, Inc. 50 Beale Street San Francisco, California 94105		10. PROGRAM ELEMENT NO. EHE624
		11. CONTRACT/GRANT NO. 68-02-1814
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Final; 10/74-6/78
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is John E. Williams, Mail Drop 61, 919/541-2483. EPA-600/2-75-050, 600/7-76-008, 600/7-77-105, and 600/7-79-244a and -244b are related progress reports.

16. ABSTRACT The report summarizes results of advanced testing (from October 1974 through June 1978) of 30,000-35,000 acfm (10 MW equivalent) lime/limestone wet scrubbers for SO2 and particulate removal at TVA's Shawnee power station. Reliable scrubber and mist eliminator operations were demonstrated. It was shown that the mist eliminator is much easier to keep clean when the scrubber is operated under conditions giving high alkali utilization. Mathematical models were developed for predicting SO2 removal in limestone, lime, and magnesium-enhanced lime/limestone scrubbers. Forced oxidation with two scrubber loops was developed on the venturi/spray tower system with limestone, lime, and limestone/MgO slurry. Bleed stream oxidation was successful only with limestone/MgO slurry. Forced oxidation with a single scrubber loop was developed on the TCA system with limestone slurry. Other test blocks included limestone type and grind, automatic limestone feed control, Ceilcote egg-crate packing in the TCA, and flue gas emission characterization.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Pollution	Sulfur Oxides	Pollution Control	13B	
Flue Gases	Dust	Stationary Sources	21B	11G
Scrubbers	Aerosols	Alkali Scrubbing	07A,13I	07D
Calcium Oxides	Mist	Particulate	07B	04B
Calcium Carbonates		Mist Eliminators		
Magnesium Oxides	Mathematical Models			12A

18. DISTRIBUTION STATEMENT Release to Public	19. SECURITY CLASS *(This Report)* Unclassified	21. NO. OF PAGES 382
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TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA-600/8-79-009	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Lime FGD Systems Data Book		5. REPORT DATE April 1979
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) T. C. Ponder Jr., J. S. Hartman, H. M. Drake, R. P. Kleir, J. S. Master, A. N. Patkar, R. D. Tems, and J. D. Tuttle		8. PERFORMING ORGANIZATION REPORT NO. P/N 3283
9. PERFORMING ORGANIZATION NAME AND ADDRESS PEDCo Environmental, Inc. 11499 Chester Road Cincinnati, Ohio 45246		10. PROGRAM ELEMENT NO. EHE624A
		11. CONTRACT/GRANT NO. 68-02-2603, Tasks 5 and 35
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development* Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Task Final; 12/76 - 12/78
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES (*) Cosponsored by Electric Power Research Institute, 3412 Hillview Ave., Palo Alto CA 94303. Project officers: W. D. Peters (IERL-RTP, 919/541-2915) and T. A. Morasky (EPRI, 415/855-2468).

16. ABSTRACT The Data Book is intended to aid engineers in understanding the process design features that are unique to lime flue gas desulfurization (FGD) systems. It is intended to supplement, not replace, basic information on engineering design. It is addressed to engineers who must design, evaluate, or operate lime FGD systems. The information may also be useful to persons who are familiar with utility operations, but unfamiliar with chemical operations. The Data Book covers the entire process of lime-based FGD. The gas-side battery limits extend from the discharge of the steam generator to the discharge of the stacks. The absorbent-side battery limits extend from receipt of the lime to sludge discharge to the final sludge disposal site.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Air Pollution	Boilers	Air Pollution Control	13B	13A
Combustion	Calcium Oxides	Stationary Sources	21B	
Sulfur Dioxide	Gas Scrubbing	Utility Boilers	07B	13H
Flue Gases		Lime		
Scrubbers		FGD Systems	07A,13I	
Desulfurization		Alkali Scrubbing	07D	
Mist		Mist Eliminators	04B	

18. DISTRIBUTION STATEMENT Unlimited	19. SECURITY CLASS (This Report) Unclassified	21. NO. OF PAGES 724
	20. SECURITY CLASS (This page) Unclassified	22. PRICE

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TECHNICAL REPORT DATA
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1. REPORT NO. EPA-600/8-80-011	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Environmental Assessment Data Systems: Terminology Reference Manual		5. REPORT DATE February 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Robert J. Larkin, Editor		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Acurex Corporation 485 Clyde Avenue Mountain View, California 94042		10. PROGRAM ELEMENT NO. EHE624A
		11. CONTRACT/GRANT NO. 68-02-2641
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Final; 5-11/79
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is Gary L. Johnson, Mail Drop 63, 919/541-2745.

16. ABSTRACT The report is a general reference manual on the terminology used to enter and retrieve information from the Environmental Assessment Data Systems (EADS), a group of interrelated computerized data bases that describe multimedia discharges from energy systems and industrial processes. The EADS was designed to aid researchers in environmental assessment, source characterization, and control technology development. The report contains the standard nomenclature or terminology used to describe certain data categories in the waste stream data bases. To selectively retrieve data from the waste stream data bases, consistent terminology must be used if the computer search is to obtain an exact match. The report contains terminology to be used to categorize sources, describe control technology, identify chemical compounds and elements, describe analytical methods in sample analysis, and list other data. The terminology applies to particle, gas, liquid, and solid discharge effluent streams.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Pollution	Pollution Control	13B
Assessments	Stationary Sources	14B
Information Systems	Environmental Assessment Data Systems	09B,05B
Terminology		
Energy Conversion Techniques	EADS	10A
Industrial Processes	Waste Streams	13H

18. DISTRIBUTION STATEMENT Release to Public	19. SECURITY CLASS *(This Report)* Unclassified	21. NO. OF PAGES 236
	20. SECURITY CLASS *(This page)* Unclassified	22. PRICE

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TECHNICAL REPORT DATA
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1. REPORT NO. EPA-600/8-80-024	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE TI-59 Programmable Calculator Programs for In-stack Opacity, Venturi Scrubbers, and Electrostatic Precipitators		5. REPORT DATE May 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) S.J. Cowen, D.S. Ensor (Atmospheric Research Group), and L.E. Sparks		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS EPA, Particulate Technology Branch Industrial Environmental Researcl Laboratory Research Triangle Park, North Carolina 27711		10. PROGRAM ELEMENT NO. EHE624A
		11. CONTRACT/GRANT NO. NA (Inhouse)
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED User Manual; 7/78-7/79
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP author Sparks can be reached at Mail Drop 61, 919/541-2925. Work of authors Cowen and Ensor was supported by EPA Grant R805650.

16. ABSTRACT The report explains the basic concepts of in-stack opacity as measured by in-stack opacity monitors. Also included are calculator programs that model the performance of venturi scrubbers and electrostatic precipitators. The effect of particulate control devices on in-stack opacity can be predicted by using these programs. The size distribution data input can be either in lognormal or histogram format. The opacity is calculated using Deirmendjian's approximation to Mie series to obtain extinction efficiencies. An alternative opacity program employing the exact Mie series solution is also described. The running time for this program is about 8 hours; that for the approximation program is 30 minutes. The accuracy of these programs is as good as the measured data input.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Pollution	Aerosols	Pollution Control	13B	07D
Approximation	Computer Programs	Stationary Sources	12A	09B
Measurement	Electrostatic Precipitators	Particulate	14B	
Flue Gases		TI-59 Calculator	21B	13I
Opacity	Scrubbers	Venturi Scrubbers		07A
Dust			11G	

18. DISTRIBUTION STATEMENT Release to Public	19. SECURITY CLASS (This Report) Unclassified	21. NO. OF PAGES 152
	20. SECURITY CLASS (This page) Unclassified	22. PRICE

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TECHNICAL REPORT DATA
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1. REPORT NO. EPA-600/8-80-027	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Guidelines for NOx Control by Combustion Modification for Coal-fired Utility Boilers		5. REPORT DATE May 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) E.H. Manny		8. PERFORMING ORGANIZATION REPORT NO. EE.116E.79
9. PERFORMING ORGANIZATION NAME AND ADDRESS Exxon Research and Engineering Company P.O. Box 101 Florham Park, New Jersey 07932		10. PROGRAM ELEMENT NO. EHE624
		11. CONTRACT/GRANT NO. 68-02-1415
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Special; 6/74-12/79
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is Robert E. Hall, Mail Drop 65, 919/541-2477.

16. ABSTRACT The report, which has been reviewed by industry experts, reflects the experience developed in successfully applying combustion modifications to reduce NOx emissions from coal-fired utility boilers. Although the report emphasizes coal-fired equipment, the same principles can be applied to gas- and oil-fired systems. Techniques, methods, and step-by-step procedures are detailed by example to guide utility personnel who may desire to conduct their own NOx emission reduction programs. Background information on operating parameters affecting NOx, necessary to understanding NOx emission control, is also included. Field studies were conducted from 1971 to 1979 to assess the feasibility of combustion modification to control NOx and other pollutants from large utility boilers. During these investigations, significant NOx reductions were demonstrated. For example, using a combination of staged combustion, low excess air firing, and other techniques reduced NOx by an average of 38%, over a range of 12 to 62%, in more than 35 utility boilers.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Air Pollution	Dust	Air Pollution Control	13B	11G
Coal	Aerosols	Stationary Sources	21D	07D
Utilities	Slagging	Combustion Modification		13H
Boilers		Staged Firing	13A	
Combustion		Low Excess Air	21B	
Nitrogen Oxides		Flue Gas Recirculation	07B	
Sulfur Oxides		Particulate		

18. DISTRIBUTION STATEMENT Release to Public	19. SECURITY CLASS (This Report) Unclassified	21. NO. OF PAGES 101
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TECHNICAL REPORT DATA
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1. REPORT NO. EPA-600/9-80-004	2. NTIS PB 80-187487	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Proceedings: Advances in Particle Sampling and Measurement (Daytona Beach, FL, October 1979)		5. REPORT DATE January 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) W.B. Smith, Editor		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Southern Research Institute 2000 Ninth Avenue, South Birmingham, Alabama 35205		10. PROGRAM ELEMENT NO. EHE624
		11. CONTRACT/GRANT NO. 68-02-3118
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Proceedings; 4-11/79
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is D. Bruce Harris, Mail Drop 62, 919/541-2557.

16. ABSTRACT The proceedings consist of 20 reports of research on equipment and techniques for sampling and characterizing particulate emissions and other aerosols. The inhalable particle size range (up to 15 micrometers) is emphasized, and the basis for selecting this range as a standard is discussed. Novel or improved equipment includes: virtual impactors; impactors for sampling high dust loadings; an impactor/quartz-crystal-microbalance combination used to sample stratospheric aerosols; a tapered-element oscillating microbalance for monitoring particulate emissions and aerosols; an automated piezoelectric microbalance for monitoring atmospheric aerosols; a hot-wire probe for measuring liquid droplets; sampling systems that are improvements on EPA Method 5 equipment for measuring mass emissions; and more efficient sampling probe inlets. New or improved techniques include: measurement of aerodynamic diameter by laser/doppler velocimetry of particles accelerated in a converging nozzle; automation of diffusion-battery/condensation nucleus counter systems; sampling inhalable particles in fugitive aerosols; particle-size spectrometry for characterizing inhalation toxicity; computer extrapolation of particle-size ranges; and the identification of impactor errors due to non-ideal behavior to particle deposition in sampling probe nozzles.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Pollution	Analyzing	Pollution Control	13B
Dust		Stationary Sources	11G
Aerosols		Particulate	07D
Measurement		Characterizing	14B
Sampling			
Properties			

18. DISTRIBUTION STATEMENT Release to Public	19. SECURITY CLASS *(This Report)* Unclassified	21. NO. OF PAGES 419
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1. REPORT NO. EPA-600/9-80-027	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Publications Bibliography -- 1971-1979 Environmental Research Center-RTP		5. REPORT DATE May 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) NA		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS EPA, Support Services Office Environmental Research Center Research Triangle Park, North Carolina 27711		10. PROGRAM ELEMENT NO. A2SR5A
		11. CONTRACT/GRANT NO. NA (Inhouse)
12. SPONSORING AGENCY NAME AND ADDRESS Office of Research and Development U.S. Environmental Protection Agency Washington, DC 20460		13. TYPE OF REPORT AND PERIOD COVERED Bibliography; 1/71-12/79
		14. SPONSORING AGENCY CODE EPA/600/00

15. SUPPLEMENTARY NOTES ERC-RTP project officer is Norman E. Childs, Mail Drop 51, 919/541-2613.

16. ABSTRACT

The report, a bibliography, lists published articles authored by the staff of the four Laboratories comprising EPA's Environmental Research Center, Research Triangle Park, NC. These are the Environmental Monitoring Systems Laboratory, the Environmental Sciences Research Laboratory, the Health Effects Research Laboratory, and the Industrial Environmental Research Laboratory. The Bibliography, inclusive for the period January 1971 - December 1979, includes some citations predating EPA's creation (December 1970). The Bibliography consists of a Key Word-in-Context Index, an Author Index, and a Publication Citations section.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Catalogs (Publications)	Environmental Sciences	05B
Bibliographies Monitors	Health Effects	14G
Laboratories Pollution	Pollution Control	14B
Environmental Engineering	Stationary Sources	05E
Environmental Surveys		05J
Environmental Biology		06F
Industries		05C

18. DISTRIBUTION STATEMENT Release to Public	19. SECURITY CLASS *(This Report)* Unclassified	21. NO. OF PAGES 435
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TECHNICAL REPORT DATA
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1. REPORT NO. EPA-600/9-80-032	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Proceedings: Fifth Industry Briefing on EPA Lime/Limestone Wet Scrubbing Test Programs (December 1979)		5. REPORT DATE July 1980
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) John E. Williams, Conference Chairman		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS See Block 12		10. PROGRAM ELEMENT NO. INE828
		11. CONTRACT/GRANT NO. N.A. (Inhouse)
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Proceedings; 12/5/79
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is John E. Williams, MD-61, 919/541-2483. EPA-600/7-79-092 is the proceedings of the August 1978 conference.

16. ABSTRACT The proceedings document presentations made during the December 5, 1979, industry briefing conference which dealt with the status of EPA/IERL-RTP's flue gas desulfurization (FGD) research, development, and application programs. Subjects considered included: lime/limestone scrubbing test results involving the organic buffer, adipic acid; limestone type and grind tests at IERL-RTP's pilot plant; IERL-RTP's program on waste solids disposal; the TVA/Shawnee lime/limestone design economic study computer program; alkali feedrate automatic control for limestone scrubbers; tests on the cocurrent scrubber at TVA/Shawnee; and forced-oxidation tests at the Widow's Creek Unit 8 full-scale limestone scrubber. The conference provided developers, vendors, users, and those concerned with regulatory guidelines with a current review of progress made in IERL-RTP's FGD technology development program.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Pollution	Oxidation	Pollution Control	13B	07C
Flue Gases	Waste Disposal	Stationary Sources	21B	
Sulfur Oxides	Power	Forced Oxidation	07B	14G
Desulfurization	Operating Costs	Energy Requirements	07A, 07D	14A, 05A
Scrubbers	Adipic Acid		13I	
Calcium Oxides				
Calcium Carbonates				

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7. AUTHOR(S) F. P. Venditti, Compiler		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Denver Research Institute P.O. Box 10127 Denver, Colorado 80208		10. PROGRAM ELEMENT NO. EHE624 11. CONTRACT/GRANT NO. R805725 (grant)
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15. SUPPLEMENTARY NOTES IERL-RTP project officer is Dennis C. Drehmel, MD-61, 919/541-2925. EPA-600/7-79-044a thru -044d are proceedings of the 1978 symposium.

16. ABSTRACT The proceedings document the approximately 120 presentations at the EPA/IERL-RTP-sponsored symposium, attended by nearly 800 representatives of a wide variety of companies (including 17 utilities). The keynote speech for the 4-day meeting was by EPA's Frank Princiotta. The meeting included a plenary session on enforcement. Attendees were polled to determine interest areas: most (488) were interested in operation and maintenance, but electrostatic precipitators (ESPs) and fabric filters were a close second (422 and 418, respectively). Particulate scrubber interest appears to be waning (288). Major activities of attendees were: users, 158; manufacturers, 184; and R and D, 182. Technical presentations drawing great interest were the application of ESPs and baghouses to power plants and the development of novel ESPs. As important alternatives to ESPs, baghouses were shown to have had general success in controlling coal-fired power plant emissions. When operating properly, baghouses can limit emissions to < 5 mg/cu nm at pressure drops of < 2 kPa. Not all baghouse installations have been completely successful. Both high pressure drop and bag loss have occurred (at the Harrington Station), but these problems appear to be solved.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Pollution	Scrubbers	Pollution Control	13B	07A
Dust	Flue Gases	Stationary Sources	11G	21B
Aerosols		Particulate	07D	
Electrostatic Precipitators		Baghouses	13I	
Filters			14G	
Fabrics			11E	

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4. TITLE AND SUBTITLE Second Symposium on the Transfer and Utilization of Particulate Control Technology (Denver, July 1979) Vol. II. Electrostatic Precipitators		5. REPORT DATE 6. PERFORMING ORGANIZATION CODE
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12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Proceedings; 6/79-6/80 14. SPONSORING AGENCY CODE EPA/600/13

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Aerosols		Particulate	07D	
Electrostatic Precipitators		Baghouses	13I	
Filters			14G	
Fabrics			11E	

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Electrostatic Precipitators		Baghouses	13I	
Filters			14G	
Fabrics			11E	

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