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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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NORTH CAROLINA 27711

May 1980

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TECHNICAL REPORT DATA
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1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO.
EPA-600/2-80-055		

4. TITLE AND SUBTITLE	5. REPORT DATE
Closed-cycle Textile Dyeing: Full-scale Hyperfiltration Demonstration (Design)	March 1980
	6. PERFORMING ORGANIZATION CODE

7. AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT NO.
Craig A. Brandon (Carre, Inc.)	

9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. PROGRAM ELEMENT NO.
LaFrance Industries LaFrance, South Carolina 29656	1BB610
	11. CONTRACT/GRANT NO. Grant No. S805182

12. SPONSORING AGENCY NAME AND ADDRESS	13. TYPE OF REPORT AND PERIOD COVERED
EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711	Phase; 9/77-4/79
	14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is Max Samfield, Mail Drop 62, 919/541-2547. EPA-600/2-76-060 is a related report.

16. ABSTRACT The report describes the first (design) phase of a full-scale demonstration of hyperfiltration for closed-cycle operations of a LaFrance Industries dye house. (The remaining three phases are installation, operation, and maintenance.) The decision to demonstrate the process was based on earlier projects that showed hyperfiltration to be potentially economical for recycle/reuse of energy, water, and chemicals in textile preparation, dyeing, and wet finishing. On-site pilot tests of three hyperfiltration modules led to the selection of the Mott-Brandon ZOPA module. Representative wash waters from LaFrance dyeing operations were characterized as a basis for demonstration equipment design. The dye range is to be converted to counterflow with a water flow rate of 50 gpm at 82 C, with 96% of the wash water recovered as permeate for direct recycle. Reuse and/or disposal of the concentrate and dye pad residuals will require further study. Payback period, without credit for chemicals recovery, is estimated to be 5.2 years.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Pollution	Pollution Control	13B
Textile Finishing	Stationary Sources	13H
Dyeing	Closed Cycle Systems	
Filtration	Hyperfiltration	07D
Regeneration		

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS *(This Report)*	21. NO. OF PAGES
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1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO.
EPA-600/7-79-178f		

4. TITLE AND SUBTITLE	5. REPORT DATE
Technology Assessment Report for Industrial Boiler Applications: NOx Combustion Modification	December 1979
	6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT NO.
K.J. Lim, R.J. Milligan, H.I. Lips, C. Castaldini, R.S. Merrill, and H.B. Mason	
9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. PROGRAM ELEMENT NO.
Acurex Corporation 485 Clyde Avenue Mountain View, California 94042	INE624
	11. CONTRACT/GRANT NO.
	68-02-3101, Task B
12. SPONSORING AGENCY NAME AND ADDRESS	13. TYPE OF REPORT AND PERIOD COVERED
EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711	Task Final: 6/78-6/79
	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 gives results of an assessment of current and developing combustion modification NOx control technology for coal-, oil-, and natural-gas-fired industrial boilers. Control effectiveness and applicability, reliability and availability, process impacts, capital and operating costs, energy impacts, and environmental impacts are evaluated. Currently available techniques are capable of moderate (10-25%) NOx reductions for coal- and residual-oil-fired boilers and major (40-70%) reductions for distillate-oil- and gas-fired units with minimal adverse operating impacts. Combustion modifications are estimated to increase the cost of steam by only 1-2%, but could increase the initial capital cost of a boiler by 1-20%. Analysis of measured or postulated incremental emissions, other than NOx, indicates that these emissions are generally unaffected when preferred NOx controls are implemented, although further testing is warranted.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Air Pollution	Operating Costs	Air Pollution Control	13B	
Assessments	Fossil Fuels	Stationary Sources	14B	21D
Combustion Control	Dust	Particulate	21B	11G
Nitrogen Oxides	Aerosols	Combustion Modification	07B	07D
Boilers	Trace Elements	Industrial Boilers	13A	06A
Capitalized Costs		Emission Factors	14A, 05A	

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS *(This Report)*	21. NO. OF PAGES
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1. REPORT NO. EPA-600/7-79-199c	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Survey of Flue Gas Desulfurization Systems: Cane Run Station, Louisville Gas and Electric Co.		5. REPORT DATE August 1979 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Bernard A. Laseke, Jr.		8. PERFORMING ORGANIZATION REPORT NO. PN 3470-1-C
9. PERFORMING ORGANIZATION NAME AND ADDRESS PEDCo Environmental, Inc. 11499 Chester Road Cincinnati, Ohio 45246		10. PROGRAM ELEMENT NO. EHE624 11. CONTRACT/GRANT NO. 68-02-2603, Task 24
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; 7/78 - 12/78 14. SPONSORING AGENCY CODE EPA/600/13
15. SUPPLEMENTARY NOTES IERL-RTP project officer is Norman Kaplan, Mail Drop 61, 919/541-2556.		

16. ABSTRACT The report gives results of a survey of operational flue gas desulfurization (FGD) systems on coal-fired utility boilers in the U.S. The FGD systems installed on Units 4, 5, and 6 at the Cane Run Station are described in terms of design and performance. The Cane Run No. 4 FGD system is a two-module (packed tower) carbide lime scrubber, retrofitted on a 178 MW (net) coal-fired boiler. The system, supplied by American Air Filter, commenced initial operation in August 1976. The Cane Run No. 5 FGD system is a two-module (spray tower) carbide lime scrubber, retrofitted on a 183 MW (net) coal-fired boiler. The system, supplied by Combustion Engineering, commenced initial operation in December 1977. The Cane Run Unit 6 FGD system is a two-module (tray tower) dual alkali (sodium carbonate/lime) scrubber, retrofitted on a 278 MW (net) coal-fired boiler. The system, supplied by A.D. Little/Combustion Equipment Associates, commenced initial operation in December 1978.

17. KEY WORDS AND DOCUMENT ANALYSIS			
a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Air Pollution	Scrubbers	Air Pollution Control	13B
Flue Gases	Coal	Stationary Sources	21B 21D
Desulfurization	Combustion	Wet Limestone	07A,07D
Fly Ash	Cost Engineering	Particulate	14A
Limestone	Sulfur Dioxide		07B
Slurries	Dust Control		11G
Ponds			08H
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1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO.
EPA-600/7-79-248		

4. TITLE AND SUBTITLE	5. REPORT DATE
Treatability and Assessment of Coal Conversion Wastewaters: Phase I	November 1979
	6. PERFORMING ORGANIZATION CODE

7. AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT NO.
P.C. Singer, J.C. Lamb III, F.K. Pfaender, and R. Goodman	

9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. PROGRAM ELEMENT NO.
University of North Carolina--Chapel Hill Department of Environmental Sciences and Engineering Chapel Hill, North Carolina 27514	EHE623A
	11. CONTRACT/GRANT NO. Grant No. R804917

12. SPONSORING AGENCY NAME AND ADDRESS	13. TYPE OF REPORT AND PERIOD COVERED
EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711	Final; 9/78 - 9/79
	14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is N. Dean Smith, Mail Drop 61, 919/541-2708.

16. ABSTRACT The report gives Phase I results of (1) an assessment of the environmental impact of wastewaters originating from the production of synthetic fuels from coal, and (2) an evaluation of alternative technologies for treating these wastewaters. Work on coagulation, adsorption, and preliminary biological treatment studies is continuing. Future reports, representing successive phases, will update these results. The major focus is on aerobic biological treatment which is projected to be the principal means of removing organic impurities from these wastewaters and a cornerstone of any overall wastewater treatment program. A synthetic wastewater, designed to simulate a real conversion process wastewater, was fed to a series of aerobic biological reactors. Design and operation of the reactors is described, along with performance data spanning two 6-month operating periods. In addition to TOC, BOD, and COD data, the treated wastewaters were analyzed for phenolic content and residual organics, using chromatographic techniques. Aquatic bioassays and mammalian cytotoxicity tests were performed on the raw and treated wastewaters to evaluate their potential environmental impact.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Pollution	Organic Compounds	Pollution Control	13B	07C
Coal	Bioassay	Stationary Sources	08G,21D	06A
Coal Gasification	Toxicity	Coal Conversion	13I	06T
Waste Water	Cytology	Synthetic Fuels		
Assessments			14B	
Water Treatment				
Aerobic Processes			06C	

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1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO.
EPA-600/7-80-014		

4. TITLE AND SUBTITLE	5. REPORT DATE
Development Study of a Novel Continuous-flow Impactor	January 1980
	6. PERFORMING ORGANIZATION CODE

7. AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT NO.
E. F. Brooks, N. Gat, M. E. Taylor, T. E. Chamberlain, R. J. Golik, and R. Watson	

9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. PROGRAM ELEMENT NO.
TRW Systems and Energy One Space Park Redondo Beach, California 90278	EHE624
	11. CONTRACT/GRANT NO.
	68-02-2165, Task 12

12. SPONSORING AGENCY NAME AND ADDRESS	13. TYPE OF REPORT AND PERIOD COVERED
EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711	Task Final; 7/76 - 11/78
	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 report gives results of a development study involving feasibility verification of a novel particle impactor in which the impaction surface is the interface between two opposing jets. Particles (which would impact a solid surface in a standard impactor) cross the interface between the aerosol-laden gas and a previously particle-free gas, are entrained in the latter, and are conveyed out for analysis. Work consisted of an initial literature search and analysis to determine the likelihood of success, followed by design, fabrication, and testing of a laboratory unit. A good particle separation capability was demonstrated. Upon completion of the laboratory tests, a design effort showed the feasibility of a staged in situ particle monitoring subsystem to give semicontinuous (nominal 1 minute cycle time) output of particle size distribution, among other applications.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Pollution	Pollution Control	13B
Dust	Stationary Sources	11G
Aerosols	Particulate	07D
Impactors	Particle Impactors	13I
Monitors		14B
Particle Size Distribution		

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS *(This Report)*	21. NO. OF PAGES
Release to Public	Unclassified	123
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TECHNICAL REPORT DATA (Please read Instructions on the reverse before completing)		
1. REPORT NO. EPA-600/7-80-017b	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Advanced Combustion Systems for Stationary Gas Turbine Engines: Volume 2. Bench Scale Evaluation		5. REPORT DATE January 1980 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) R. M. Pierce, S. A. Mosier, C. E. Smith, and B. S. Hinton		8. PERFORMING ORGANIZATION REPORT NO. FR-11405
9. PERFORMING ORGANIZATION NAME AND ADDRESS Pratt and Whitney Aircraft Group United Technologies Corporation P.O. Box 2691 West Palm Beach, Florida 33402		10. PROGRAM ELEMENT NO. INE829 11. CONTRACT/GRANT NO. 68-02-2136
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; 9/76 - 1/78 14. SPONSORING AGENCY CODE EPA/600/13
15. SUPPLEMENTARY NOTES IERL-RTP project officer is W.S. Lanier, Mail Drop 65, 919/541-2432.		

16. ABSTRACT The reports describe an exploratory development program to identify, evaluate, and demonstrate dry techniques for significantly reducing NOx emissions from stationary gas turbine combustors. (Volume 1 documents the research activities leading to selection of 26 combustor design concepts which could potentially meet the program goals.) Volume 2 documents the Phase II bench-scale evaluation of those concepts to experimentally evaluate their emission reduction potential. Results from the testing program identified two design approaches capable of significant emission reduction. A staged centertube design, relying on burner operation near the lean blowout limit, gave low NOx and CO emissions on clean No. 2 fuel oil, but was ineffective for fuels containing bound nitrogen. A rich-burn/quick-quench (RB/QQ) design, producing a fuel-rich primary zone and quickly quenching the effluent from that region to the high overall excess air conditions required by the gas turbine cycle, successfully controls NOx from both thermal and fuel-bound sources while maintaining low CO emissions for high thermal efficiency. The RB/QQ concept was selected for scaleup to full size hardware in Phases III and IV.

17. KEY WORDS AND DOCUMENT ANALYSIS			
a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Pollution	Combustion Chambers	Pollution Control	13B
Gas Turbine Engines		Stationary Sources	21E
Stationary Engines	Flammability	Unburned Hydrocarbons	21K
Nitrogen Oxides		Combustor Design	07B
Carbon Monoxide		Staged Combustion	
Hydrocarbons		Dry Controls	07C
Combustion		Fuel Nitrogen	21B
18. DISTRIBUTION STATEMENT Release to Public		19. SECURITY CLASS (This Report) Unclassified	21. NO. OF PAGES 350
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1. REPORT NO. EPA-600/7-80-017c	2.
3. RECIPIENT'S ACCESSION NO.	
4. TITLE AND SUBTITLE Advanced Combustion Systems for Stationary Gas Turbine Engines: Volume 3. Combustor Verification Testing	5. REPORT DATE January 1980
	6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) R.M. Pierce, C.E. Smith, and B.S. Hinton	8. PERFORMING ORGANIZATION REPORT NO. FR-11405
9. PERFORMING ORGANIZATION NAME AND ADDRESS Pratt and Whitney Aircraft Group United Technologies Corporation P.O. Box 2691 West Palm Beach, Florida 33402	10. PROGRAM ELEMENT NO. INE829 11. CONTRACT/GRANT NO. 68-02-2136
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; 1/78 - 4/79 14. SPONSORING AGENCY CODE EPA/600/13
15. SUPPLEMENTARY NOTES IERL-RTP project officer is W.S. Lanier, Mail Drop 65, 919/541-2432.	

16. ABSTRACT The reports describe an exploratory development program to identify, evaluate, and demonstrate dry techniques for significantly reducing NOx from stationary gas turbine engines. (Volume 1 describes Phase I research activities to compile a series of combustor design concepts which could potentially meet the program goals, and Volume 2 describes the Phase II bench-scale evaluation of those techniques: the rich-burn/quick-quench (RB/QQ) concept was found to be effective in limiting pollutant emissions when burning either clean fuels or fuels containing significant amounts of chemically bound nitrogen.) Volume 3 describes the scaleup of the RB/QQ model to a full-scale (25 MW) gas turbine combustor, and documents test results from the full-scale evaluations. Test results were very positive, showing that the RB/QQ concept can reduce NOx to approximately 45 ppm (at zero % O2) for clean distillate oil and to approximately 75 ppm for a distillate oil doped to 0.5% nitrogen, as pyridine. CO emissions below the 100 ppm program goal were also demonstrated. These tests also indicate that the new combustor concept may be capable of low emission performance on petroleum residual oil and synthetic liquid fuels such as SRC II or shale oil. Results from testing on those fuels is included in Volume 4, an addendum.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Pollution	Atomizing	Pollution Control	13B	13H
Gas Turbine Engines	Shale Oil	Stationary Sources	21E	21D
Stationary Engines		Combustor Design	21K	
Nitrogen Oxides		Staged Combustion	07B	
Carbon Monoxide		Dry Controls		
Combustion		Fuel Preparation	21B	
Combustion Chambers		Fuel-bound Nitrogen		

18. DISTRIBUTION STATEMENT Release to Public	19. SECURITY CLASS *(This Report)* Unclassified	21. NO. OF PAGES 152
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1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO.
EPA-600/7-80-017d		

4. TITLE AND SUBTITLE	5. REPORT DATE
Advanced Combustion Systems for Stationary Gas Turbine Engines: Volume 4. Combustor Verification Testing (Addendum)	January 1980
	6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT NO.
R.M. Pierce, C.E. Smith, and B.S. Hinton	FR-11405
9. PERFORMING ORGANIZATION NAME AND ADDRESS Pratt and Whitney Aircraft Group United Technologies Corporation P.O. Box 2691 West Palm Beach, Florida 33402	10. PROGRAM ELEMENT NO. INE829 11. CONTRACT/GRANT NO. 68-02-2136
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; 7/79 - 10/79 14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is W.S. Lanier, Mail Drop 65, 919/541-2432.

16. ABSTRACT The reports describe an exploratory development program to identify, evaluate, and demonstrate dry techniques for significantly reducing NOx from stationary gas turbine engines. (Volume 1 describes Phase I research activities to compile a series of combustor design concepts which could potentially meet the program's low emission goals. Volume 2 covers the Phase II bench-scale testing program which experimentally singled out the rich-burn/quick-quench (RB/QQ) combustor concept as being capable of low NOx and CO operation on both clean fuels and fuels containing significant amounts of bound nitrogen. Volume 3 covers the Phase III and IV scaleup and full-scale testing of the RB/QQ concept, documenting the fact that all emission goals could be met with the RB/QQ combustor.) Volume 4 describes an additional series of tests to evaluate the performance of the combustor on heavy fuels such as petroleum or shale residual oil and solvent refined coal (SRC). Results from the tests show that all exhaust emission goals were met while burning three test fuels: a middle-cut distillate SRC, a residual shale oil, and an Indonesian/Malaysian residual oil. It was also demonstrated that the exhaust emission goals were met when operating a RB/QQ combustor at a high turbine inlet temperature (1426 C design) firing No. 2 fuel oil.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Pollution	Residual Oils	Pollution Control	13B	21D
Gas Turbine Engines	Shale Oil	Stationary Sources	21E	
Stationary Engines	Coal	Combustor Design	21K	
Nitrogen Oxides	Liquefaction	Staged Combustion	07B	07D
Combustion		Dry Controls	21B	
Combustion Chambers		Fuel-bound Nitrogen		

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS *(This Report)*	21. NO. OF PAGES
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1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO.
EPA-600/7-80-026		

4. TITLE AND SUBTITLE	5. REPORT DATE
Assessment of Corrosion Products from Once-through Cooling Systems with Mechanical Antifouling Devices	January 1980
	6. PERFORMING ORGANIZATION CODE

7. AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT NO.
Charles M. Spooner	

9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. PROGRAM ELEMENT NO.
GCA/Technology Division Burlington Road Bedford, Massachusetts 01730	INE827
	11. CONTRACT/GRANT NO.
	68-02-2607, Task 28

12. SPONSORING AGENCY NAME AND ADDRESS	13. TYPE OF REPORT AND PERIOD COVERED
EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711	Task Final; 1-4/79
	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 assessment of corrosion products from steam-electric power plant once-through cooling systems equipped with mechanical antifouling devices. (About 67% of the currently operating plants in the U.S. use once-through cooling systems. Various cleaning mechanisms, used to minimize the reduction of the thermal efficiency of heat exchange in the condenser tubes--caused by corrosion and biofouling--include chemical and off- and on-line mechanical methods.) On-line mechanical cleaning may lead to increased levels of metals in the effluent due to abrasion of the condenser tubes. Since some abraded metals at sufficiently high concentrations harm aquatic organisms and lead to other environmental damage, metal concentrations in cooling water discharges which stem from on-line mechanical condenser tube cleaning systems need to be determined. This report addresses the significance of this effect, based mainly on comments from utilities experienced with the Amertap system and from the manufacturer. The industry generally does not keep a close account of the causes and magnitude of condenser tube corrosion; however, based on observations offered by the utilities, the Amertap and other systems do not appear to contribute to loss of metal through abrasion in any measurable way. Further evaluation is recommended.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Pollution	Assessments	Pollution Control	13B	14B
Steam Electric	Condenser Tubes	Stationary Sources		
Power Generation	Cooling Water	Biofouling	10A	
Cooling Systems		Mechanical Antifouling	13A	
Corrosion Products		Devices	11M	
Biodeterioration			06A	

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1. REPORT NO. EPA-600/7-80-036	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Investigation of NO2/NOx Ratios in Point Source Plumes		5. REPORT DATE February 1980 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) J. P. Blanks, E. P. Hamilton III, B. R. Eppright, and N. A. Nielsen		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Radian Corporation P.O. Box 9948 Austin, Texas 78766		10. PROGRAM ELEMENT NO. INE624 11. CONTRACT/GRANT NO. 68-02-2608, Task 63
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; 12/78 - 12/79 14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is J. David Mobley, Mail Drop 61, 919/541-2915. EPA-600/7-78-212 is a related report.

16. ABSTRACT The report gives results of a study to relate ground level NO2 concentrations to NOx emissions (NO2/NOx ratio) in plumes from six large power plants in the Chicago area, using a photostationary state reactive Gaussian plume model. The aim of the study was to assess the level of NOx control required to meet a probable short-term NO2 national ambient air quality standard (NAAQS). The major uncertainty of an earlier study (EPA-600/7-78-212) was its assumption of uniform, fixed NO2/NOx ratios of 0.5 (summer) and 0.25 (winter). The reactive model used in this study predicted significantly higher NO2/NOx ratios at the point of maximum plume impact (0.93 for worst case) with high ambient ozone levels (0.2 ppm). Average NO2/NOx ratios for all high ozone cases studied were 0.76-0.9. The reactive model predicts significantly higher ground level NOx impacts from the six plants. These results indicate that the threshold short-term NO2 NAAQS level requiring NOx flue gas treatment technology could increase by 40%. The previous study indicated that most of the six plants could meet a 500 microgram/cu m short-term NO2 standard using NOx combustion modification techniques (50% NOx control); this study indicates NOx flue gas treatment technology (90% control) may be required on these plants to meet a 750 microgram/cu m standard, and most certainly for 500 micrograms/cu m.

17. KEY WORDS AND DOCUMENT ANALYSIS		
a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Pollution Combustion Nitrogen Oxides Nitrogen Dioxide Mathematical Modeling Normal Density Functions Flue Gases Electric Power Plants Ozone	Pollution Control Stationary Sources Gaussian Models	13B 21B 10B 07B 12A
18. DISTRIBUTION STATEMENT Release to Public	19. SECURITY CLASS (This Report) Unclassified 20. SECURITY CLASS (This page) Unclassified	21. NO. OF PAGES 71 22. PRICE

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TECHNICAL REPORT DATA (Please read Instructions on the reverse before completing)		
1. REPORT NO. EPA-600/7-80-037	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Pilot-scale Field Tests of High-gradient Magnetic Filtration		5. REPORT DATE March 1980 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Charles H. Gooding		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. EHE624A 11. CONTRACT/GRANT NO. 68-02-2650
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; 9/77 - 12/79 14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is Dennis C. Drehmel, Mail Drop 61, 919/541-2925.

16. ABSTRACT The report gives results of using a 5100 cu m/hr mobile pilot plant to evaluate the effectiveness and economics of applying high-gradient magnetic filtration (HGMF) to particulate emission control. A 4-1/2 month test program was conducted at a Pennsylvania sintering plant to characterize the performance of the pilot plant and to demonstrate its practicality under long-term operation. The pilot plant collected approximately 90% of the iron-bearing particulate under practical operating conditions but achieved lower overall collection because the windbox gas contained an unexpectedly high concentration of fine alkali-chloride aerosol. To collect the non-magnetic aerosol, a finer filter had to be used under conditions that were conducive to plugging. Under the practical conditions, the pilot plant operated over 450 hours without significant problems. Analysis of the results indicates that high-efficiency collection can be achieved economically if HGMF is applied to steel industry dusts that are more homogeneous and more strongly magnetic than the tested sinter dust. The report describes laboratory pilot-plant work that demonstrated collection efficiencies greater than 99% with basic oxygen furnace and electric arc furnace dusts. The development of a filter cleaning system and the design and construction of the pilot plant are discussed. Experimental data are reported.

17. KEY WORDS AND DOCUMENT ANALYSIS				
a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Pollution	Aerosols	Pollution Control	13B	
Filtration	Sintering Furnaces	Stationary Sources	07D	13A
Magnetic Properties	Iron and Steel Industry	High-gradient Magnetic Filtration	20C	
Magnetic Separators			13I	11F
Testing		Particulate	14B	
Dust			11G	

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS (This Report)	21. NO. OF PAGES
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1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO.
EPA-600/7-80-038		

4. TITLE AND SUBTITLE	5. REPORT DATE
Photochemical Study of NOx Removal from Stack Gases	March 1980
	6. PERFORMING ORGANIZATION CODE

7. AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT NO.
John R. Richards and Donald L. Fox	

9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. PROGRAM ELEMENT NO.
University of North Carolina School of Public Health Chapel Hill, North Carolina 27514	INE623
	11. CONTRACT/GRANT NO.
	Grant No. R804740

12. SPONSORING AGENCY NAME AND ADDRESS	13. TYPE OF REPORT AND PERIOD COVERED
EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711	Final; 1/77 - 3/79
	14. SPONSORING AGENCY CODE
	EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is Joseph A. McSorley, Mail Drop 63, 919/541-2745.

16. ABSTRACT The report gives results of an evaluation of the technical feasibility of a photochemical pretreatment system for NOx control at coal-fired boilers. The approach utilizes reaction mechanisms similar to those responsible for photochemical oxidant incidents. The reactions are initiated under controlled conditions while the pollutants are at high concentration and while the reaction products can be removed. Results indicate that, under time- and light-limited conditions, it is possible to quench the photochemical reactions at the NO2 peak and prior to the formation of ozone, aerosols, and other secondary products. Energy and hydrocarbon requirements were estimated in a series of 159 experimental runs. The optimal operating conditions were identified as a NOx/C3H6 stoichiometric ratio of 1 and an NO2 photolysis rate of 1 to 1.5 reciprocal minutes (equivalent to 3 to 5% station power). These conditions allowed for an 83% oxidation of NO with an exit concentration of NO less than 100 ppm. Variation of the energy input levels or the propylene injection rates resulted in NO oxidation efficiencies of 10 to 99%. Photochemical oxidation of NO was insensitive to SO2 concentration and CO2 concentration. The photochemical system appears compatible with conditions resulting from combustion modifications to suppress NOx generation.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Pollution Combustion Photochemical Reactions Oxidation Boilers Flue Gases Propylene Nitrogen Oxides Coal	Pollution Control Stationary Sources	13B 07E 07B,07C 13A 21B 21D

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS *(This Report)*	21. NO. OF PAGES
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1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO.
EPA-600/7-80-042		

4. TITLE AND SUBTITLE	5. REPORT DATE
Performance of a High-velocity Pulse-jet Filter, II	March 1980
	6. PERFORMING ORGANIZATION CODE

7. AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT NO.
David Leith, M.J. Ellenbecker, M.W. First, J.M. Price, Anthony Martin, and D.G. Gibson	

9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. PROGRAM ELEMENT NO.
Harvard School of Public Health 665 Huntington Avenue Boston, Massachusetts 02115	EHE624
	11. CONTRACT/GRANT NO. Grant R804700

12. SPONSORING AGENCY NAME AND ADDRESS	13. TYPE OF REPORT AND PERIOD COVERED
EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711	Final; 9/76-9/79
	14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is James H. Turner, Mail Drop 61, 919/541-2925. EPA-600/7-78-131 includes related work.

16. ABSTRACT The report gives results of a study of the performance of a high-velocity pulse-jet filter. Such filtration has distinct advantages over low-velocity filtration in that the equipment required to clean a gas stream is reduced in size and initial cost as velocity increases. Although high filtration velocity causes a number of problems, many of them are dealt with in the report. Location of the gas inlet to the filter was found to affect penetration and pressure drop; both were higher for inlets near the bottom of the filter housing. Fabric type was also found to affect performance by affecting the amount and characteristics of the dust deposit accumulated. Fabric surface properties help explain the nature of this deposit. These ideas and others were used to develop a mathematical model for pressure drop in a pulse-jet cleaned filter. The model can be used to predict pressure drop under stable or variable operating conditions, and to predict operating conditions that cause unstable filter operation. An understanding of particle/fiber interactions is essential to understanding the collection characteristics of a felt fabric. Under certain conditions, particles bounce on impact with fibers. An adhesion probability was determined and found to depend on incident particle kinetic energy.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Pollution	Pollution Control	13B
Filtration	Stationary Sources	07D
Pulsation	Fabric Filters	14B
Jets	Pulse-jet Filters	20D
Fabrics		11E
Mathematical Models		12A
Felts		
Adhesion		

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS *(This Report)*	21. NO. OF PAGES
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EPA-600/7-80-043		

4. TITLE AND SUBTITLE	5. REPORT DATE
Pilot Scale Combustion Evaluation of Waste and Alternate Fuels: Phase III Final Report	March 1980
	6. PERFORMING ORGANIZATION CODE

7. AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT NO.
R.A. Brown and C.F. Busch	

9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. PROGRAM ELEMENT NO.
Acurex Corporation Energy and Environmental Division 485 Clyde Avenue Mountain View, California 94042	EHE624A
	11. CONTRACT/GRANT NO. 68-02-1885

12. SPONSORING AGENCY NAME AND ADDRESS	13. TYPE OF REPORT AND PERIOD COVERED
EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711	Phase III Final; 2-8/78
	14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is David G. Lachapelle, Mail Drop 65, 919/541-2236. EPA-600/7-79-132 was the Phase II final report; there was no Phase I final report.

16. ABSTRACT The report gives results of three studies at EPA's Multifuel Test Facility. The first evaluated a distributed-air staging concept for NOx control in pulverized-coal-fired systems. The results showed that minimum NO levels of 140 ppm were achieved at overall residence times similar to those used during conventional staging tests. However, the NO levels achieved with the distributed-air concept were no lower than those achievable with conventional staging. The second evaluated combustion control techniques and NO emissions when firing coal/oil mixtures. NO emissions for a given burner and nozzle were generally proportional to the fuel-nitrogen content of the fuel. Additionally, combustion control technology currently used for NOx control from pulverized coal was found to be effective with coal/oil mixtures, but to differing degrees, depending on the coal/oil mixture ratios and compositions. The third evaluated emissions and combustion characteristics of refuse-derived fuel (RDF) co-fired with either natural gas or pulverized coal. Four RDF materials were evaluated for gaseous, particulate, trace metal, and organic emissions. In general: CO and UHC emissions were low; NOx and SOx emissions decreased with increasing RDF content when co-fired with coal; particulate levels did not substantially increase with the RDF; and no trace metal emissions correlation was found.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Pollution	Pollution Control	13B
Fuel Oil	Stationary Sources	07B
Nitrogen Oxides	Staged Combustion	21B
Combustion Control	Refuse-derived Fuel	
Refuse	Coal/Oil Mixtures	
Wastes	Alternate Fuels	21D
Coal		

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EPA-600/7-80-049		

4. TITLE AND SUBTITLE	5. REPORT DATE
Residual Oxidants Removal from Coastal Power Plant Cooling System Discharges: Field Evaluation of SO2 Addition System	March 1980
	6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT NO.
K. Scheyer and G. Houser	
9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. PROGRAM ELEMENT NO.
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EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711	Task Final; 1-11/79
	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 the performance of a dechlorination system that uses SO2 to remove residual oxidants from chlorinated sea water in a power plant cooling system. Samples of unchlorinated, chlorinated, and dechlorinated cooling water were obtained at Pacific Gas and Electric's Potrero power plant in San Francisco. The samples were collected during 28 sampling periods--14 at flood tide and 14 at ebb tide--and analyzed for several chemical and physical constituents. An amperometric titrator was used for field analysis of total oxidant residual (TOR) and free oxidant residual (FOR). Analytical results, plant operating data, and laboratory experiments were used to evaluate the dechlorination system. Major conclusions include: (1) the dechlorination system studied showed effective removal of residual oxidants from chlorinated sea water used in the power plant cooling system; (2) the dechlorination system proved reliable (no measurable oxidant residual was found at the effluent outfall); and (3) due to the effectiveness of the dechlorination system in removing all measurable oxidant residual, average and maximum levels of dechlorination cannot be determined.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Pollution Oxidizers Dechlorination Cooling Systems Sea Water Electric Power Plants Sulfur Dioxide	Pollution Control Stationary Sources Oxidant Removal	13B 11G 07A,07B,07C 13A 08J 10B

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4. TITLE AND SUBTITLE	5. REPORT DATE
Proceedings: First Symposium on Iron and Steel Pollution Abatement Technology (Chicago, IL, 10/30-11/1/79)	February 1980
	6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT NO.
Franklin A. Ayer, Compiler	
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EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711	Proceedings; 3/79 - 2/80
	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 documents presentations at the first EPA-sponsored symposium devoted solely to pollution abatement technology for the iron and steel industry, held in Chicago, IL, October 30 - November 1, 1979. The symposium was organized into air, water, and solids sessions. Air pollution topics included: emission standards, assessment of coke quench tower and by-product recovery plant emissions, sealing of coke-oven doors, volatilization of hydrocarbons in steel rolling operations, development of a coke-oven air pollution control cost effectiveness model, control of sinter plant emissions utilizing recirculation of windbox gases, estimating fugitive contributions to ambient particulate levels near steel mills, foreign technology for BOF fugitive emission control, and fugitive particulate emission factors for BOF operations. Water topics included emission standards, total recycle of water in integrated steel mills, use of spent pickle liquor in municipal sewage treatment, physical/chemical treatment of steel plant wastewaters using mobile pilot units, foreign technology forcontrolling coke plant and blast furnace wastewaters, and formation and structure of water-formed scales. Solid waste topics included emission standards, environmental and resource conservation considerations of steel industry solid waste, and de-oiling and utilization of mill scale.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Pollution	Mathematical Models	Pollution Control	13B	12A
Iron and Steel Industry		Stationary Sources	11F	
Emission	Sintering	Emission Standards		
Assessments	Dust	Fugitive Dust	14B	11G
Coking	Waste Disposal		13H	
Hydrocarbons	Chemical Cleaning		07C	

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