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Environmental Protection
Agency

Center for Environmental Research
Information
Cincinnati OH 45268

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EPA TECHNOLOGY TRANSFER

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ERIC NOW CERI

The EPA acronym ERIC (Environmental Research Information Center) is also a copyrighted name for a DHEW organizational unit. To avoid confusion, we have changed our name to Center for Environmental Research Information (CERI). Requests for Technology Transfer material should be sent to: USEPA, Center for Environmental Research Information, Cincinnati, Ohio 45268

Design Manual for Sludge Treatment and Disposal Featured at 1979 WPCF Conference

The Technology Transfer revised "Process Design Manual for Sludge Treatment and Disposal" is being distributed at the 52nd Annual Conference and Exhibition of the Water Pollution Control Federation (WPCF) in Houston, Texas.

This edition of the sludge manual is a completely updated and greatly expanded version of the manual published in 1974. Many new sections are included which discuss sludge production, disinfection, heat drying, transportation, storage, sidestreams from solids treatment processes, instrumentation and utilization. This revision is an Office of Research and Development effort conducted by the Municipal Environmental Research Laboratory and the Center for Environmental Research Information. The information compiled in the manual is intended to assist municipalities in meeting the solids treatment and disposal requirements as mandated in the 1977 Clean Water Act as amended, Public Law 95-217.

This year's WPCF Conference attendance is estimated at over 12,000, the largest ever. Forty-five technical program sessions and three preconference workshops have been scheduled. Display space spanning over 84,000 square feet is set aside for products and exhibits of more than 300 manufacturing firms and support organizations.

Several EPA organizations have pooled resources to form an EPA referral and display area. The EPA exhibits feature (1) the Center for Environmental Research Information (formerly ERIC), (2) Water Quality Management (Clean Lakes, 404 and 208 Programs), (3) National Training and Operational Technology Center, (4) Municipal Construction and Operation and Maintenance, (5) Effluent Guidelines and (6) Facilities Requirements Division. Key individuals will be available at each exhibit to discuss EPA policy and answer questions. We invite you to visit the EPA displays, meet CERI personnel at Booth 2300, and pick up a copy of the Sludge Treatment and Disposal Design Manual. To order this Manual (#1011) return the order form at the back of this Newsletter.

Fate of Priority Pollutants in Publicly Owned Treatment Works Pilot Study Summary

Introduction

The United States Environmental Protection Agency (EPA) has initiated a program to study the occurrence and fate of 129 selected toxic organic and inorganic pollutants (priority pollutants) by means of a sampling program at 40 Publicly Owned Treatment Works (POTW's). The major goals of the program are to characterize the impact of toxic pollutants on the POTW treatment process and to study the effects of secondary treatment on priority pollutants The data obtained from this study may impact the pretreatment regulations for indirect dischargers.

The first phase of the program was a pilot study of two POTW's to determine the optimum field methodologies to be used throughout the program and to develop preliminary conclusions regarding the incidence, impact and fate of priority pollutants in POTW's which will be substantiated as the sampling progresses through the 40 plants. Also examined in this study were the overall removal of priority pollutants in POTW influents, the concentration of priority pollutants in sludge and the formation of chlorinated hydrocarbons during chlorine disinfection

The determination of optimum field methodologies included selecting parameters of interest and establishing technical procedures for sampling. This involved (1) determining sampling points which best characterize information regarding fate of priority pollutants, (2) establishing sampling frequency for obtaining the most representative picture of wastewater fluctuations, and (3) developing analytical protocol for samples to assure that consistent and accurate results are obtained throughout the study.

The Study

The two POTW's sampled (A & B) for the program are conventional activated sludge plants but differ significantly in size, percent industrial flow, age, operation, sludge conditioning methodology and capacity utilized.

Plant A has an average daily flow of 96 to 108 mgd, 30 percent of which is industrial waste, primarily from major industries including pharmaceutical manufacture, petrochemicals, plating operations, automotive foundries, coking operations and food processing plants. Sludge conditioning methods include primary sludge thickening by gravity thickeners, secondary by Dissolved Air Flotation (DAF), vacuum filtration and incineration.

The flow to Plant B is primarily residential with an average daily flow of 8 to 10 mgd, 2 percent of which is from industries: grain elevators, oil and fuel terminals, machine tool and metal working companies and box and insulation companies. Plant B sludge is combined from holding tanks with thickened (via DAF) waste activated sludge. This combined sludge passes to conditioning facilities and to vacuum filtration. The filtercake is incinerated and the decant is recycled to the sludge operation.

The wastewater treatment train at each plant is nearly identical, consisting of grit chambers, pre-aeration, primary settling, aeration, secondary settling and chlorination. At both POTW's, the sampling points for the study were chosen to best represent the wastewater at particular stages of treatment. The sampling scheme for both plants was nearly identical, and included sampling points for the influent, the effluent before chlorination, the final effluent, each of the various sludge conditions and the tap water. At Plant A, however, the primary and secondary sludge, the floatables, combined sludge and the vacuum filtrate were sampled, while at Plant B only the combined and secondary (before and after DAF) sludge were sampled.

Sampling spanned one week at each plant—with an additional week of sampling influent only at Plant A. Sampling consisted of 7-day, 24-hour composites and grab samples. Automatic samplers were used wherever continuous flow existed. As an aid for comparison of plant data, identical sampling techniques and EPA sampling protocols[1] were followed.

Results

Examination of the data collected from Plants A and B can be summarized as follows. The more industrial Plant A influent contained a higher incidence of priority pollutants than Plant B influent. In total, 52 organic priority pollutants were found in the Plant A influent (18 over detection limits) and only 33 in the Plant B raw wastewater (5 over detection limits). Seven of the nine metallic priority pollutants detected in the influents to both plants had higher concentrations in the Plant A influent.

In Plant A, the metallic priority pollutants present in detectable amounts were removed reasonably well. Antimony, arsenic, beryllium, selenium and thallium were never found above detection limits in influent or effluent samples. Chromium and copper were reduced to less than 50 µg/l (90 and 86 percent removal, respectively). Cadmium, nickel and zinc were removed somewhat less effectively, averaging 59 to 65 percent. Lead and silver were removed to below detection limits. Also, eight of nine organic priority pollutants detected in Plant A influent, with an average concentration of over 10 µg/l, were reduced by a minimum of 50 percent (benzene, 1,1,1-trichloroethylene, chloroform, ethylbenzene, bis(2-ethyl-

[1]Guidelines Establishing Test Procedures for the Analysis of Pollutants To be published in the *Federal Register* Proposed Amendments to 40 CFR Part 136

hexyl) phthalate, tetrachloroethylene, toluene and trichloroethylene). Only phenol was not effectively removed. Metals at Plant B were found at relatively low concentrations. As in Plant A, antimony, arsenic, beryllium, selenium and thallium were not measured above detection limits in either the influent or effluent Cadmium and silver were both reduced from several micrograms per liter to below detection limits Cadmium, copper and zinc were reduced effectively, between 69 and 81 percent. Lead and nickel were removed less effectively Organic priority pollutants at Plant B occurred at such low concentrations that removal data were not meaningful.

Most of the metals at Plant A were present at high concentrations in both the primary and secondary sludge. Cadmium, copper, lead, nickel and zinc were each found in primary sludge at concentrations over 100 times greater than in the influent. Chromium and cyanide were found in the primary sludge at 30 to 50 times the influent concentration Antimony, arsenic, and beryllium, which were never measured above detection limits in the influent, were all measured in the primary sludge Several organic priority pollutants detected at very low concentrations in the influent accumulated in the primary or secondary sludge. Among these were acenaphthene (0 to 1 μg/l average in the influent and 169 μg/l in the primary sludge), 1,2-benzanthracene (<1 and 479), 3,4-benzofluoranthene (not detected and 675), fluorene (<3 and 313) and pyrene (<3 and 757). Plant B data indicated the same general trends for metals as in Plant A. Chromium, copper, lead, nickel and zinc were found in the combined sludge at approximately 100 times their concentrations in the influent. Arsenic, cadmium, cyanide, mercury and silver also accumulated in the sludge, but occurred at overall lower levels Antimony, beryllium, selenium and thallium, which were never measured above detection limits in the influent were all found at concentrations below 50μg/l in the sludge. Several of the organic priority pollutants which were present at very low concentrations in influent also were more concentrated in the sludge. They included acrylonitrile (not detected in the influent and 41 μg/l in the combined sludge), dichlorobromomethane (0-1 and 74) and 3,4-benzofluoranthene (not detected and 43).

Mass balances were analyzed at each plant to compare the concentrations entering (influent) and leaving (effluent and sludge) the POTW. The metallic priority pollutants at Plant A balanced moderately well. Most of the metals accumulated in the sludge. The concentrations of cadmium, chromium, copper, lead, nickel, silver and zinc in the sludge were each 2 to 15 times the amounts in the final effluent. However, copper, lead and zinc balanced poorly. Arsenic was detected in Plant A's sludge (4 lb/day) but was not measured above the detection limit in the influent. Some organic priority pollutants balanced poorly, perhaps due to the release of volatile substances to the atmosphere, a removal mechanism termed air stripping. However, concentrations of other organic pollutants which are less volatile, were found concentrated in the sludge Accumulation of pollutants in the sludge at Plant B was less pronounced than at Plant A due to the lower concentrations of priority pollutants in the influent. A few metals accumulated to a relatively small degree in the sludge (chromium, copper, lead and zinc) and all of these were found in greater quantity in the combined sludge than in the final effluent. There were insufficient data upon which to draw conclusions regarding the organic priority pollutant removal mechanisms or concentrations in sludges at Plant B

Samples from the chlorine contact chambers and receiving streams were analyzed for the possible formation of chlorinated hydrocarbons Results from sampling and analysis show that formation of chlorinated hydrocarbons does occur.

Sampling frequency experiments showed that influent metallic priority pollutant concentrations at Plant A increased during the week and dipped during the weekends and that high concentrations were also observed during the 8:00 a.m. to 4.00 p.m. work-day period. This variation was not evident in Plant B's system Organic pollutant concentrations were too low to show significant trends.

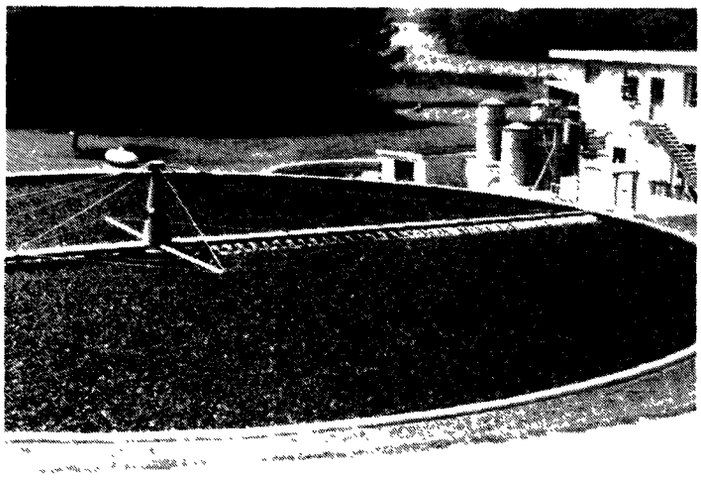
The initial phase of study for the program has now been completed and results from this two-plant investigation have been published (EPA-440/1-79-300) and are available at the Water Pollution Control Federation Conference through the Effluent Guidelines Division, booth 2300, and from the Center for Environmental Research Information

New Seminar Series: Sludge Treatment and Disposal

The Cincinnati-based Municipal Environmental Research Laboratory and Center for Environmental Research Information are planning a Technology Transfer design seminar series on sludge treatment and disposal If sufficient interest is expressed, the series would begin in early or mid 1980. The proposed series would focus on the effect of the 1977 Clean Water Act as amended and the Resource Conservation and Recovery Act on the design of sludge treatment and disposal facilities The seminars would be based on the newly revised Process Design Manual on Sludge Treatment and Disposal (see story on page 1) A small registration fee may be required. If you are interested in this proposed seminar series, contact Dr James E. Smith, USEPA—CERI, Cincinnati, Ohio 45268, (513) 684-7394.

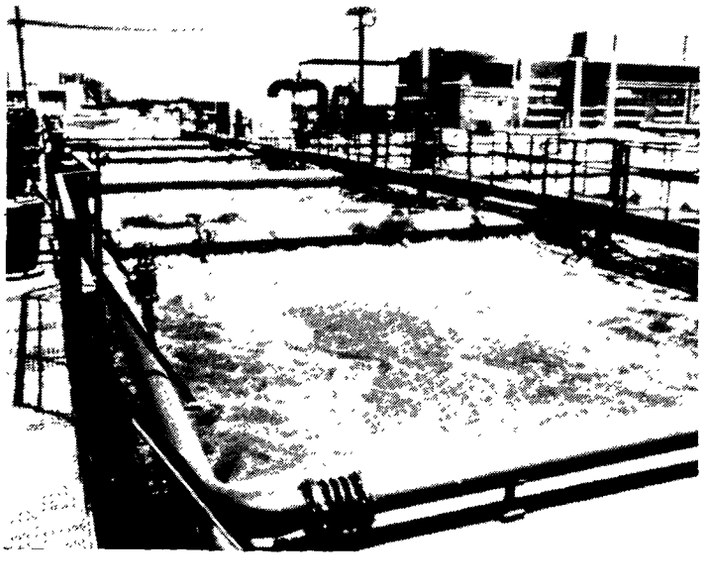
Publication Update: Municipal Wastewater Alternatives

The brochure, "Environmental Pollution Control Alternatives: Municipal Wastewater," has been updated and reprinted. Originally written in 1976, the brochure describes alternatives for treating municipal wastewaters, including primary and secondary treatment (such as trickling filters and activated sludge), disinfection, advanced treatment (such as carbon adsorption and nitrogen control), flow equalization and sludge treatment and disposal methods (such as conditioning and thickening). Figures pertaining to energy requirements and costs for the various alternatives are significantly updated. To receive a copy of the revised brochure (#5012) return the order form at the back of this Newsletter.



Trickling Filter

Sludge Drying Bed



Activated Sludge Aeration Tank

Aerated Lagoon

New Capsule Report: Bahco FGD and Particulate Removal System

A new Technology Transfer capsule report, "Bahco Flue Gas Desulfurization and Particulate Removal Systems," describes a Research — Cottrell/Bahco scrubber module for SO_2 and particulate emission control, at the central heat plant of Rickenbacker Air Force Base near Columbus, Ohio The capsule report describes flue gas desulfurization technology using any fuel, including high sulfur oil or coal Fuel is burned in conventional equipment in a manner both cost effective and environmentally acceptable The capsule report (#2022) can be ordered by returning the form at the back of this Newsletter

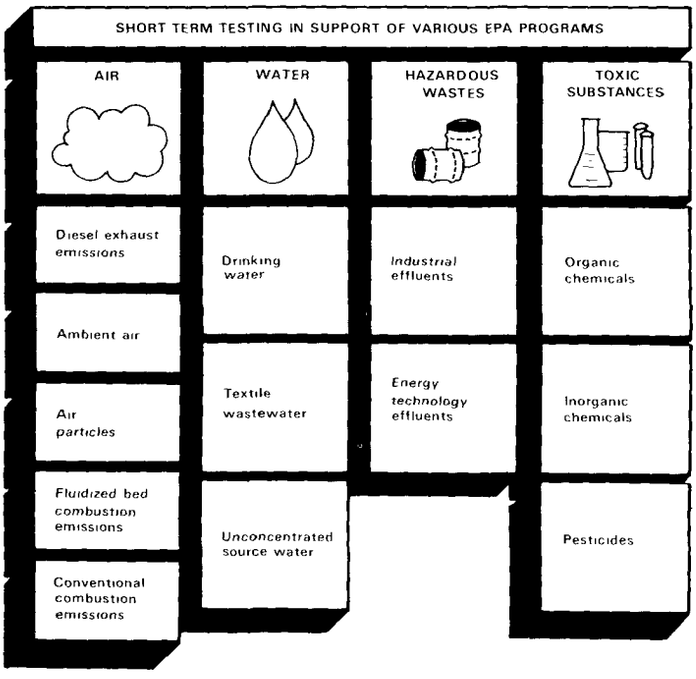
The Bahco System at Rickenbacker Air Force Base

New Environmental Assessment Report on Short-Term Testing

The Center for Environmental Research Information has published the first of a new series of Technology Transfer reports on "Environmental Assessment." This series is somewhat different from other Technology Transfer publications in that the topics, rather than focusing on control technology or environmental engineering, will deal with issues involving toxic substances and their effects on human health and the environment Since much of the Agency's effort and resources are now directed to regulating the release of toxic chemicals into the environment, the "Assessment" series was developed to provide a means for collecting and disseminating the information evolving from this effort. These reports are intended for an audience whose chief concern is protection of human health.

The first report in the series is entitled, "Short-Term Tests for Carcinogens, Mutagens and Other Genotoxic Agents " Short-term tests are techniques developed to serve as rapid and relatively inexpensive predictors of a chemical's potential to alter genetic material The report describes the way in which short-term tests contribute to toxic material effects assessment The scientific basis for and techniques used in the tests, as well as current applications and research activities are also described.

A copy of this report (#9003) can be ordered by returning the order form at the back of this Newsletter



New Design Seminars for Small Wastewater Treatment Systems

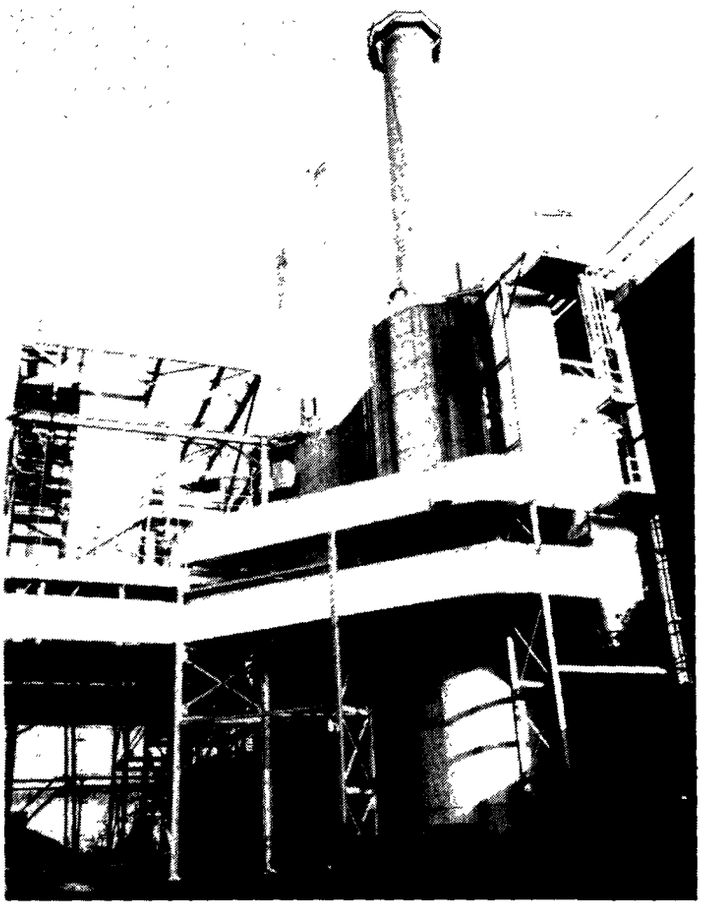
To date, five Technology Transfer Seminars on "Wastewater Treatment Facilities for Small Communities" have been presented in 1979: Phoenix, Arizona, July 17-19; Portland, Oregon, July 31 - August 2; Omaha, Nebraska, August 14-16; Indianapolis, Indiana, August 28-30; and New Orleans, Louisiana, September 18-20.

Nationwide, in years past, a total of 20 seminars have been presented on this topic; however, the five 1979 seminars included two new technical sessions: "Management of On-site and Alternative Wastewater Systems," and "Planning Wastewater Management Facilities for Small Communities." The management session, presented by Peter Ciotoli and Kenneth Wiswall of Roy F. Weston, Inc , West Chester, Pennsylvania, included discussions of management needs, functions and dimensions (various types of institutional approaches which can be utilized). Actual case studies were used to illustrate the management session. These studies, which involved extended field trips by planners and engineers, evaluated actual administrative and operational practices utilized in several communities and states. Among the case studies discussed are Fairfax County, Virginia, Lake Meade, Pennsylvania; Otter Tail County, Minnesota; Stinson Beach, California; and the State of Maryland.

The planning session, presented by James Hudson, Patricia Deese and Robert McMahon of Urban Systems Research and Engineering, Inc., Cambridge, Massachusetts, and James Lake and Robert Williams of the National Association of Conservation Districts, Washington, D.C., included information designed to aid engineers and the small communities they serve in applying and evaluating various methods for wastewater management This information is intended to impact the early steps in the planning process, particularly the preapplication and facility planning (step 1) stages of the construction grants program. Major topics addressed at the seminar were institutional and regulatory setting; the application process, development of a community profile; technical problem identification and generation and evaluation of systems for the community as a whole.

New Capsule Report: Particulate Control by Fabric Filtration on Coal-Fired Industrial Boilers

Conversion of oil- and gas- to coal-fired boilers and the promulgation of more stringent particulate emission regulations, have sparked a renewed interest in the use of fabric filtration for boiler particulate control. A new capsule report, describing theory, applications, performance and economics of fabric filtration, is available. To order this report (#2021) return the form at the back of this Newsletter



"Stacks, baghouse and duct system at typical coal-fired boiler plant"

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- Carbon Adsorption (Oct 1973) 1002 ☐
- Suspended Solids Removal (Jan 1975) 1003 ☐
- Upgrading Existing Wastewater Treatment Plants (Oct 1974) 1004 ☐
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- Land Treatment of Municipal Wastewater (Oct 1977) 1008 ☐
- Wastewater Treatment Facilities for Sewered Small Communities (Oct 1977) 1009 ☐
- Municipal Sludge Landfills (Oct 1978) 1010 ☐
- ● Sludge Treatment and Disposal (Oct 1979) 1011 ☐

TECHNICAL CAPSULE REPORTS

- Recycling Zinc in Viscose Rayon Plants by Two Stage Precipitation 2001 ☐
- Color Removal from Kraft Pulping Effluent by Lime Addition 2002 ☐
- Pollution Abatement in a Copper Wire Mill 2003 ☐
- First Progress Report Limestone Wet-Scrubbing Test Results at the EPA Alkali Scrubbing Test Facility 2004 ☐
- Pollution Abatement in a Brewing Facility 2006 ☐
- Flue Gas Desulfurization and Sulfuric Acid Production via Magnesia Scrubbing 2007 ☐
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- Magnesium Carbonate Process for Water Treatment 2009 ☐
- Third Progress Report Lime/Limestone Wet-Scrubbing Test Results at the EPA Alkali Scrubbing Test Facility 2010 ☐
- First Progress Report Wellman-Lord SO_2 Recovery Process — Flue Gas Desulfurization Plant 2011 ☐
- Swirl Device for Regulating and Treating Combined Sewer Overflows 2012 ☐
- Fabric Filter Particulate Control on Coal-Fired Utility Boilers Nucla, CO and Sunbury,PA 2013 ☐
- First Progress Report Static Pile Composting of Wastewater Sludge 2014 ☐
- Efficient Treatment of Small Municipal Flows at Dawson, MN 2015 ☐
- Double Alkali Flue Gas Desulfurization System Applied at the General Motors Parma, OH Facility 2016 ☐
- Recovery of Spent Sulfuric Acid from Steel Pickling Operations 2017 ☐
- Fourth Progress Report Forced-Oxidation Test Results at the EPA Alkali Scrubbing Test Facility 2018 ☐
- Control of Acidic Air Pollutants by Coated Baghouses 2020 ☐
- ● Particulate Control by Fabric Filtration on Coal-Fired Industrial Boilers 2021 ☐
- ● Bahco Flue Gas Desulfurization and Particulate Removal System 2022 ☐

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HANDBOOKS

- Monitoring Industrial Wastewater (1973) 6002 ☐
- Industrial Guide for Air Pollution Control (June 1978) 6004 ☐
- Continuous Air Pollution Source Monitoring Systems (June 1979) 6005 ☐

INDUSTRIAL ENVIRONMENTAL POLLUTION CONTROL MANUALS

- Pulp and Paper Industry Part 1, Air (Oct 1976) 7001 ☐
- Textile Processing Industry (Oct 1978) 7002 ☐

SUMMARY REPORTS

- Sulfur Oxides Control Technology Series FGD Wellman-Lord Process 8001 ☐
- Control Technology for the Metal-Finishing Industry Series Evaporators 8002 ☐

EXECUTIVE BRIEFINGS

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- ● Short-Term Tests for Carcinogens, Mutagens and Other Genotoxic Agents 9003 ☐

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