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EPA TECHNOLOGY TRANSFER The Bridge Between Research and Use

Summary of National Operational and Maintenance Cause and Effect Survey

Francis L. Evans III
Urban Systems Management Section
Municipal Environmental Research Laboratory, USEPA
Cincinnati, Ohio

Significant potential exists for improving the performance of biological treatment systems simply and inexpensively by upgrading operation and maintenance programs, improving attention to management and administrative requirements, and by making low-cost correction of design deficiencies.

These are the results of the first large-scale effort in this country to identify and quantify specific cause and effect relationships in problems of performance, operation, and maintenance of biological wastewater treatment plants A three and one-half year study was conducted nationwide to collect and analyze data from a statistically significant number of operating plants The purpose of the study was to identify deficiencies which caused poor plant performance, to weigh and rank, in order of severity of impact, the causative factors of poor performance at each facility, and to demonstrate on a limited basis the improvement in plant performance that can be achieved without major capital improvement when *all* limiting factors are corrected.

Selection Criteria

Plants were selected for study based on sequential screening and selection procedures. EPA regional offices and state regulatory agencies assisted in initial selection of plants by compiling a list of potential study sites. Plants not meeting one or more of the following general screening criteria were eliminated from the selection process:

1. The plant must incorporate some variation of suspended growth, fixed film, or aerated lagoon biological treatment
2. The plant should not be severely hydraulically or organically overloaded, nor have obvious identifiable structural or component deficiencies.
3. The plants should range in size up to 10 mgd and all major units should be operating
4. No enforcement action should be underway or pending against the municipality or authority involved

A total of 287 site visits were made to collect more detailed data than the original screening information in order to select those plants at which comprehensive evaluations would be conducted. These initial site visits required one-half to one full day at each facility to evaluate such things as process flow sheets, influent and effluent wastewater characteristics; condition of equipment, and discharge permit criteria. Also, the plant superintendent and operating personnel were questioned regarding problems they saw as interfering with plant operations

One hundred and eighty-four facilities were eliminated for various reasons at this stage of the study; thus, 103 facilities remained as best suited for comprehensive evaluation. The purpose of the comprehensive evaluation was to examine, in detail, the system and unit process performance and to evaluate existing operation, maintenance, and administrative practices. Each plant evaluation involved a team of professional engineers and plant operating personnel and required three to five days of on-site field work. In all, 70 potential problem areas were addressed at each facility.

In order to quantify and report the deficiencies and problems at plant sites, both individually and collectively, a plant evaluation summary was developed, consisting of a weighing scale and a ranking table. The scale was devised to rank the 70 different factors that could limit plant performance. For each factor identified at a facility, the extent to which it adversely impacted plant performance was quantified according to the weighing scale points as defined in Table 1. The factors affecting plant performance were then ranked in decreasing order of severity.

TABLE 1. WEIGHING SCALE USED TO QUANTIFY ADVERSE IMPACT

Weighing Scale	Effect of Specific Factor on Plant Performance
0	*No* significant effect on plant performance
1	*Minor* effect on plant performance
2	*Minimum* indirect effect on plant performance on *continuous* basis or *major* direct effect on plant performance on a *periodic* basis
3	*Major* direct effect on plant performance

Major Causes of Poor Plant Performance

Based on the results of the comprehensive surveys, the 10 highest ranking causes of poor plant performance result from inadequate plant operation and plant design deficiencies. The highest-ranking factor (#1) was inadequate operator application of concepts and testing to process control. This, coupled with the fourth-ranked factor, inadequate understanding of wastewater treatment, indicates that for various reasons operators were not applying the proper concepts of operation to process control. These reasons are attributable to inadequate or incorrect sampling and testing procedures for process control (Factor #2), improper technical guidance (Factor #5), ineffective O&M manual instruction (Factor #9), and significant design deficiencies (Factors #3, 6, 7, 8, and 10), all of which prevent an operator from controlling and "tuning" his treatment system to varying influent hydraulic and pollutant loading characteristics.

The 10 major causes of poor plant performance are described as follows:

1. **Operator Application of Concepts and Testing to Process Control**—This factor was ranked as the most severe deficiency and leading cause of poor performance at 23 facilities and was a high-ranked factor at a total of 89 out of the 103 plants evaluated. It occurs when a trained operator in a satisfactorily designed plant permits less than optimum performance. This factor was ranked when incorrect control adjustment or incorrect control test interpretation occurred, or when the use of existing inadequate design features continued when seemingly obvious operations alternatives or minor plant modifications could have been implemented to improve performance. The lack of testing and control were not necessarily the result of inadequate training or comprehension in these areas, but simply the lack of or inability to apply learned techniques.

2. **Process Control Testing Procedures**—Inadequate process control testing involves the absence or wrong type of sampling or testing for process monitoring and operational control. This deficiency leads to making inappropriate decisions. Standard unit process tests such as mixed liquor suspended solids, mixed liquor dissolved oxygen, mixed liquor settleable solids, and return sludge suspended solids for activated sludge processes were seldom or never conducted. Also, important operating parameters such as sludge volume index, F:M ratio and mean cell retention time in suspended growth systems or recirculation rates in trickling filter plants were usually not determined This factor adversely impacted performance at 67 of the 103 plants evaluated.

3. **Infiltration/Inflow**—The results of this widespread problem are manifested by severe fluctuations in flow rates, periods of severe hydraulic overloading, and dilution of the influent wastewater so that both suspended and fixed biological systems are loaded to less than optimal values. The extreme result is the "washout" of suspended growth systems as a result of the loss of solids from the final clarification stage during high flow periods. This factor was ranked first at 56 of the 103 plants evaluated.

4. **Inadequate Understanding of Wastewater Treatment**—This factor is distinguished from Factor #1 in that it is defined as a deficiency in the level of

knowledge that individual staffs at various facilities exhibit concerning wastewater treatment fundamentals. On occasion, an operator's primary concern is simply to keep the equipment functional rather than to learn how the equipment relates to the processes and their control. This factor adversely affected performance at 50 plants and was the leading cause of poor performance at nine facilities.

5. **Technical Guidance**—Improper technical guidance includes misinformation from authoritative sources including design engineers, state and federal regulatory agency personnel, equipment suppliers, operator training staff and other plant operators. At any one plant, improper technical guidance was observed to come from more than one source. This factor was ranked as the most severe deficiency at seven plants, and was an adverse factor at 47 facilities.

6. **Sludge Wasting Capability**—This factor was ranked as the leading cause of poor performance at nine facilities and was a factor at 43 plants studied. This factor includes inadequate sludge handling facilities and the inability to measure and control the volume of waste sludge. Either one or both of these conditions was noted as having a major impact on performance at several plants.

7. **Process Controllability**—The lack of controllability was evident in the inability to adequately measure and control flow streams such as return sludge flow and trickling filter recirculation rates. While measurement and control of return activated sludge flow were the most frequent reasons for rating this factor, process controllability was not a major cause of poor performance. It prevented an operator from "tuning" his treatment system to the varying demands which were placed on it by hydraulic and organic loading fluctuations. This factor occurred at 55 plants and was the leading factor at three facilities

8. **Process Flexibility**—Lack of flexibility refers to the unavailability of valves, piping and other appurtenances required to operate in various modes or to include or exclude existing processes as necessary to optimize performance. Poor flexibility precludes the ability to operate an activated sludge plant in the contact stabilization, step loading or conventional modes and the ability to bypass polishing ponds or other downstream processes to discharge high quality secondary clarifier effluent. Either the lack of, or inadequate, process flexibility was noted as the leading cause of poor performance at three plants and was a factor at 37 facilities.

9. **Ineffective O&M Manual Instruction**—This situation, existing at 40 plants, was judged serious although the adverse effect was moderate. The poor quality of most plants' O&M manuals undoubtedly has contributed to operators' general lack of understanding of the importance of process control and the inability to practice it, but a competent staff could use other available information sources.

10. **Aerator Design**—Deficiencies in aerator design were the major cause of poor performance at six facilities and were less significant factors at an additional 21 plants. Deficiencies were noted in the type, size, shape, capacity, and location of the unit and were of such a nature as to hinder adequate treatment of the waste flow and loading and stable operation.

In addition to the top 10 causes of poor plant performance as described above, the 70 potential problem areas were weighed and ranked for all plants studied. Table 2 lists the factors in decreasing order of severity of impact on performance. For each factor the area of design, operation, maintenance, or administration is identified. Also shown is the number of times that a factor was ranked Number 1; i.e., the number of times the factor was the leading cause of poor performance, and also the number of plants at which the factor had a "minor" or more serious adverse impact on plant performance In some cases, plant evaluations did not include every factor being evaluated for potential adverse impact. These factors are marked in the table by an asterisk. However, all factors were noted as having an adverse impact either when the factor was present and a deficiency or an adverse effect was observed or when the factor was not present and an adverse effect resulted from its absence. As noted on the table, *operational problems* and *design deficiencies* comprise the top 16 leading causes of poor plant performance.

TABLE 2. COLLECTIVE RANKING OF FACTORS LIMITING PLANT PERFORMANCE

Limiting Factor			No of Times	
Factor	Area	Description	Factor was ranked #1	Factor was noted
1	Operation	Operator Application of Concepts & Testing to Process Control	24	89
2	Operation	Process Control Testing	0	67
3	Design	Infiltration/Inflow	9	56
4	Operation	Sewage Treatment Understanding	9	50

TABLE 2. cont'd

Limiting Factor			No of Times	
Factor	Area	Description	Factor was ranked #1	Factor was noted
5	Operation	Technical Guidance	7	47
6	Design	Sludge Wasting & Return Capability	9	43
7	Design	Secondary Process Controllability	3	55
8	Design	Secondary Process Flexibility	3	37
9	Operation	O&M Manual Inadequacy(*)	0	40
10	Design	Aerator	6	27
11	Design	Sludge Treatment(*)	3	36
12	Design	Industrial Loading	4	27
13	Operation	Staff Training	0	31
14	Design	Secondary Clarifier	3	26
15	Operation	Performance Monitoring	0	31
16	Design	Ultimate Sludge Disposal	1	30
17	Administration	Plant Administration, Familiarity with Needs	2	21
18	Design	Disinfection(*)	1	20
19	Administration	Plant Staff - Number	2	22
20	Design	Plant Hydraulic Loading	0	18
21	Administration	Plant Staff - Plant Coverage	0	26
22	Maintenance	Spare Parts Inventory	0	23
23	Design	Laboratory Space & Equipment	0	30
24	Design	Return Process Stream	1	18
25	Operation	Equipment Malfunction	2	17
26	Maintenance	Lack of Preventive Maintenance Program	1	20
27	Design	Alternative Power Source	0	24
28	Design	Organic Loading	7	13
29	Maintenance	General Housekeeping	0	17
30	Maintenance	Maintenance Scheduling & Recording	0	19
31	Administration	Administration Policies	2	15
32	Administration	Plant Staff Productivity	0	17
33	Administration	Insufficient Funding	1	16
34	Maintenance	Manpower	0	14
35	Design	Preliminary Unit Design(*)	0	20
36	Administration	Staff Motivation	0	19
37	Administration	Working Conditions	0	18
38	Design	Alarm Systems	0	19
39	Maintenance	Critical Parts Procurement	0	14
40	Design	Flow Proportioning to Units	0	12
41	Operation	Staff Aptitude	0	13
42	Design	Inoperability Due to Weather	0	12
43	Administration	Staff Supervision	0	13
44	Design	Primary Units(*)	1	9
45	Maintenance	Equipment Age	0	14
46	Operation	O&M Manual - Use by Operators(*)	0	12
47	Administration	Salary	0	12
48	Design	Lack of Standby Units for Key Equipment	0	9
49	Design	Lack of Unit By-Pass	0	12
50	Maintenance	Technical Guidance - Emergencies	0	10
51	Maintenance	Availability of Preventive Maintenance Ref.	0	10
52	Design	Flow Backup	0	7
53	Operation	Staff - Level of Education	0	9
54	Design	Toxic Loading	1	8
55	Design	Submerged Weirs	0	6
56	Design	Plant Location	0	6
57	Operation	Staff Level of Certification	0	8
58	Operation	Staff - Insufficient Time on Job	0	7
59	Maintenance	Staff Expertise - Emergencies	0	9
60	Design	Seasonal Variation Loading	0	7
61	Administration	Unnecessary Expenditures	0	7
62	Design	Process Automation for Control	1	6
63	Administration	Personnel Turnover	0	4

TABLE 2. cont'd

Limiting Factor			No. of Times	
Factor	Area	Description	Factor was ranked #1	Factor was noted
64	Operation	Shift Staff Adequacy	0	3
65	Design	Unit Accessibility	0	3
66	Design	Process Accessibility for Sampling	0	4
67	Design	Process Automation for Monitoring	0	2
68	Design	Equipment Accessibility for Maintenance	0	2
69	Administration	Bond Indebtedness	0	0
70	Design	AWT Units(*)	0	0

*Not included in every plant evaluated

Program for Improving Plant Performance

In a critical evaluation of the data, it is important to note that at each treatment facility, *a combination of factors limiting performance was always observed* and that a single cause of poor performance at any one facility was never observed. Because there is an interrelationship between performance limiting factors and corrective programs, and because most existing correction programs focus on single problems only, a new approach which addresses all problems at a single facility is proposed as a more effective approach in improving existing plant performance This approach is called a *Composite Correction Program* (CCP). The purpose of the CCP is to eliminate *all* the performance limiting factors at a plant through the implementation of the correction recommendations that are made in the comprehensive evaluation report. The CCP was successfully demonstrated at several facilities on a limited scale. When the program was implemented at the Havre, Montana Wastewater Treatment Plant, a significant improvement in plant effluent quality resulted and permit standards could be met consistently. At the Havre plant, the effluent quality for six months prior to implementation of the CCP averaged 31 mg/l for BOD_5 and 30 mg/l for TSS. Both BOD_5 and TSS concentrations averaged less than 10 mg/l for an eight-month period following initiation of the CCP and development of desired activated sludge characteristics. The plant's BOD_5 loading increased by 27%, yet BOD_5 discharged to the receiving stream decreased by 68%.

At other facilities where the CCP technical assistance approach was used, improved performance resulted from changes in plant operations or minor changes in plant design features The improvement in effluent quality that was achieved is shown in Table 3

TABLE 3. COLLECTIVE RANKING OF FACTORS LIMITING PLANT PERFORMANCE

Facility	Flow	Effluent Quality BOD_5 (mg/l)		Effluent Quality TSS (mg l)		Major Impact
	MGD	Before CCP	After CCP	Before CCP	After CCP	
Havre, MT	1 36	31	10	30	8	Improved Performance
Marshfield, MO	0 48	75	8	150	5	Improved Performance
St Charles, MO Mississippi R Plant	3 12	9	5	2	2	Increased Process Stability
Akron, IA	0 13	72	21	143	8	Improved Performance
Belton, MO	0 84	23	10	34	15	Improved Performance and Decreased Costs of Sludge Handling

The significance and impact of a CCP approach to optimizing plant performance are indicated by improved effluent quality at the Havre facility and by the potential improvements which could be realized if such a program were implemented at all the facilities at which comprehensive evaluations were performed. Of the 103 facilities evaluated only 37 plants (36%) were meeting their respective NPDES standards consistently or most of the time. However, if as a result of the evaluations, the recommendations were implemented, an additional 51 treatment plants could consistently meet NPDES standards, and 88 plants (86%) would achieve optimal levels of performance beyond which further improvement in effluent quality would not be possible without upgrading the existing facilities.

Conclusions and Recommendations

The following conclusions and specific recommendations are made as a result of this study:

1. Since operator training programs and manuals are ineffective aids and have minimal impact on insuring proper plant operation, all federal and state training programs and literature should be redeveloped to relate theoretical consideration to practical operational situations and present solutions to specific on-site problems as they arise. Manuals must reflect the input of the plant operations staff and should be easy to follow so they will be used on a day-to-day basis.

2. At the facilities planning and design stages, plant design, operability, and flexibility should be subject to a specific design and O&M review as a grant-funding requirement. Such a review would serve to:

   a. Emphasize the need for adequate sludge handling in small plants and design, operation and management of existing facilities at large plants.

   b. Insure proper design of secondary clarifiers to eliminate short circuiting and insure uniform velocity gradients in the sludge blanket.

   c. Implement more rational design requirements for fixed-film biological reactors.

   d. Allow and encourage separate treatment of anaerobic digester supernatant or require increased wastewater treatment process unit sizes to adequately receive and treat this recycle flow.

   e. Encourage plant flexibility which would allow bypassing of ponds following mechanical plants and flexibility to operate activated sludge plants in various modes.

   f. Emphasize good controllability of return activated sludge flows.

3. In order to assure that process control is practiced at treatment facilities, the following action should be taken.

   a. Improve training for private and governmental persons disseminating operations technical assistance. Training must include *guided in-plant process control experience* at various wastewater treatment facilities to develop capabilities for proper application of wastewater treatment concepts to process control. Plant design engineers should be trained in plant operations and process control

   b. Provide more comprehensive and understandable process control information to operators by design engineers and technical assistance sources. Such information should be included in the plant operation and maintenance manual, which in turn should reference other manuals provided through state and federal government for augmentation and clarification of theory as necessary.

   c. Hold persons who disseminate operations technical guidance accountable for their recommendations. As a minimum, follow-up phone calls or plant visits should be used to determine if recommendations given *were correct* and *still apply*.

4. Studies to determine the sources of plant performance problems should be comprehensive in order that subtle as well as obvious factors which limit performance are identified. The performance potential of an existing plant should be verified by conducting a comprehensive evaluation to identify all factors limiting performance. Plant administrators should be informed of the CCP approach to improving plant performance as an alternative to construction of major plant modifications.

5. Federal and state regulatory efforts should be directed toward enforcement and accountability, specifically to:

   a Expand enforcement of NPDES permits to encourage optimum performance from existing facilities.

   b. Require that CCP's be implemented prior to or in conjunction with construction of new or modified facilities to insure that existing facilities' capabilities are examined and optimized before unneeded construction is begun.

6. Budgeting for operation and maintenance of wastewater treatment facilities must become more organized and needs-sensitive. Higher priority for wastewater treatment in the municipal budget must be established.

Publications and Presentations Resulting from National O&M Cause and Effect Survey

— "Evaluation of Operation and Maintenance Factors Limiting Municipal Wastewater Treatment Plant Performance," Pres. Rocky Mountain Water Pollution Control Association, Albuquerque, New Mexico, October 25, 1977.

— Hegg, B.A., Rakness, K.L., and Schultz, J.R.; "Evaluation of Operation and Maintenance Factors Limiting Municipal Wastewater Treatment Plant Performance," JWPCF, 50:3, 419-426, March 1978.

— "Evaluation of Operation and Maintenance Factors Limiting Municipal Wastewater Plant Performance—Phase II," Pres. 51st Conference WPCF, Anaheim, California, October 1978.

— "Operational Factors Affecting Performance of Biological Treatment Plants," Pres. 51st Annual Conference WPCF, Anaheim, California, October 1978.

— "Evaluation of Operation and Maintenance Factors Limiting Municipal Wastewater Treatment Plant Performance," EPA-600/2-79-034, June 1979.

— "Evaluation of Operation and Maintenance Factors Limiting Biological Wastewater Treatment Plant Performance," EPA-600/2-79-078, July 1979.

— "A Demonstrated Approach for Improving Performance and Reliability of Biological Wastewater Treatment Plants," EPA-600/2-79-035, June 1979.

— "Evaluation of Design, Operation, Maintenance and Administrative Factors Limiting Treatment Plant Performance—Phase II," Draft Final Report, May 1979.

— "Evaluation of Operation Maintenance Factors Limiting Biological Treatment Plant Performance—Phase II," Draft Final Report, June 1979.

New Seminar Series: Innovative and Alternative Technology Assessment

The Environmental Research Information Center and the Water Research Division of the Municipal Environmental Research Laboratory are jointly sponsoring a series of Technology Transfer seminars designed to aid in the implementation of EPA's new Innovative and Alternative Technology (I/A) Program.

This program was established by Congress as a modification of the EPA Construction Grants Program to allow communities to obtain more than 75% federal grant money for construction of wastewater treatment facilities.

Provisions of the program include:

— 85% grants for the construction of innovative or alternative municipal treatment plants instead of the normal 75% grants.

— The above grant increase (75% to 85%) will be paid out of a special fund set aside from each state's allocation each year that can only be used for I/A technology. This set-aside fund is 2% for the first two years (FY 79 and 80) and 3% for the last year (FY 81).

— Each year ½% of the special set-aside fund must be used for innovative technology.

— If a new I/A technology fails to meet design goals during the first two years of operation, another grant may be awarded for 100% of the costs of replacing the failed system. This means the local government and the taxpayers will not have to pay for new technologies that do not work.

Nine, two-day seminars have been scheduled during the period August through December 1979 to acquaint engineers and facilities planning personnel with the technical information necessary to fulfill the program requirements. Attendance is limited to 200 participants at each seminar. Seminar sites and dates are listed on page 14 of this Newsletter. If you are interested in attending one of these seminars contact:

Liz Holzer
JACA Corporation
550 Pinetown Road
Fort Washington, PA 19034
(215) 643-5466

Land Treatment Seminars

The Environmental Research Information Center, in cooperation with the U.S. Army Corps of Engineers, presented five Technology Transfer seminars in June on the "Design of Land Treatment of Municipal Wastewater Effluents."

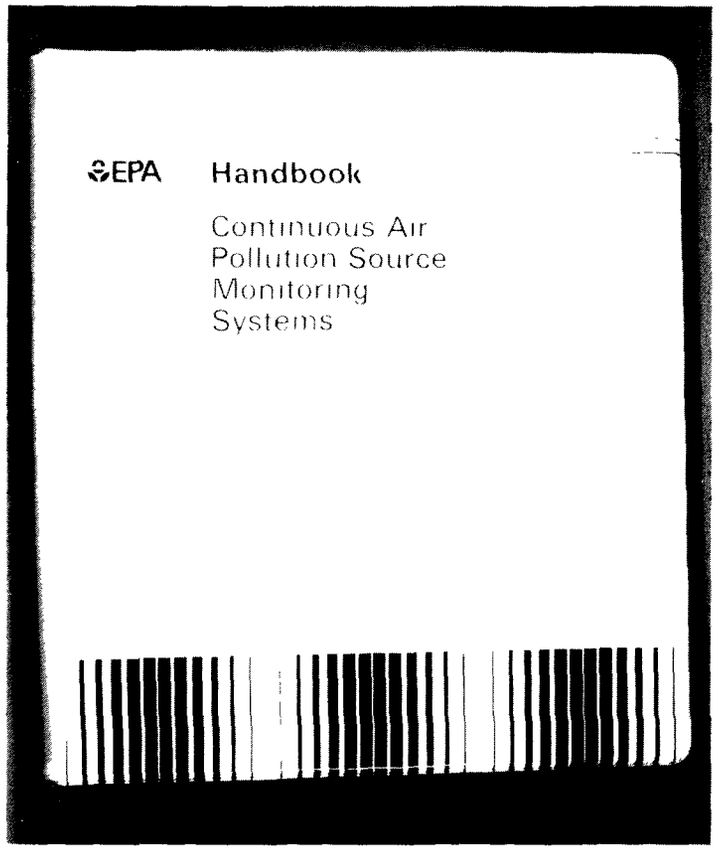
These seminars were held in Des Plaines, Illinois; Atlanta, Georgia; Boston, Massachusetts; Phoenix, Arizona; and Boise, Idaho. Subjects discussed included land treatment systems, slow rate, high rate, and overland flow; health aspects; management and monitoring options; development of public relations programs, design examples for each treatment-mode, and selected case histories. EPA's revised policy and guidance for evaluation of land treatment alternatives (PRM 79-3) in the Construction Grants program was also covered

Continuous Source Monitoring Handbook Featured at 1979 APCA Meeting

The newest Technology Transfer handbook, "Continuous Air Pollution Source Monitoring Systems," was distributed for the first time at the 72nd Annual Air Pollution Control Association Meeting and Exhibition, held June 26-28 at the Cincinnati Convention Center.

EPA was represented at the meeting by the Environmental Research Information Center and the Industrial Environmental Research Laboratories (Cincinnati, Ohio and Research Triangle Park, North Carolina) who combined efforts this year to provide information to attendees about EPA programs and to discuss the handbook. Approximately 2000 copies of the new publication were distributed.

The Source Monitoring handbook provides the detailed information necessary to develop a continuous emissions monitoring program at a stationary source facility. It also covers continuous monitoring requirements established by the federal government, general guidelines to aid in meeting these requirements, details for selecting monitoring instrumentation, and methods for using monitoring data and systems to improve and optimize source process operations The manual can be obtained by returning the order form at the back of this Newsletter (#6005).



Symposium Announcement: River Basin Water Planning and Management

The Environmental Research Information Center is helping to coordinate a joint USA/USSR symposium on "River Basin Water Quality Planning and Management," which will be held in the Sheraton-Commander Hotel,Cambridge, Massachusetts, October 22-24. The U S. participation in the symposium is sponsored by the U S. Environmental Protection Agency, Water Planning Division, and Region 1, as part of an on-going effort by both countries to promote the exchange of scientific information and, in this case, to better understand the water planning and management activities of each The USSR will be represented by the research scientists of the All-Union Scientific Research Institute for Water Protection (VNIIVO), an equivalent agency to EPA with broad responsibilities for the planning, research and design of water pollution control systems and strategies

The main focus of the symposium will be to comparatively study the water protection planning methods and approaches of both countries, stressing the technological, regulatory and institutional constraints The U.S. specialists will prepare a river basin water protection plan for a segment of the Severski-Donet River in the Ukraine Republic, applying U.S. laws, regulations and technologies. The Soviet specialists will prepare a similar water plan for a segment of the Connecticut River in Massachusetts, based on Soviet constraints and planning approaches. Each group of representatives will present seven papers which will include discussions on present and future water quality goals, regulations; agencies involved in water pollution control planning and management; decision-making processes, including considerations of treatment technologies; water quality modeling; and cost/benefit optimization.

Also of interest to symposim participants will be discussions by the Soviets of some of their treatment technologies and pollution abatement/management methods which are not generally applied in the United States.

Attendance at this symposium is open to anyone who is interested. For further information, contact.

Ms. Sharon Moore
Water Quality Branch
U S Environmental Protection Agency
JFK Federal Building
Boston, MA 02203
(617) 223-5130

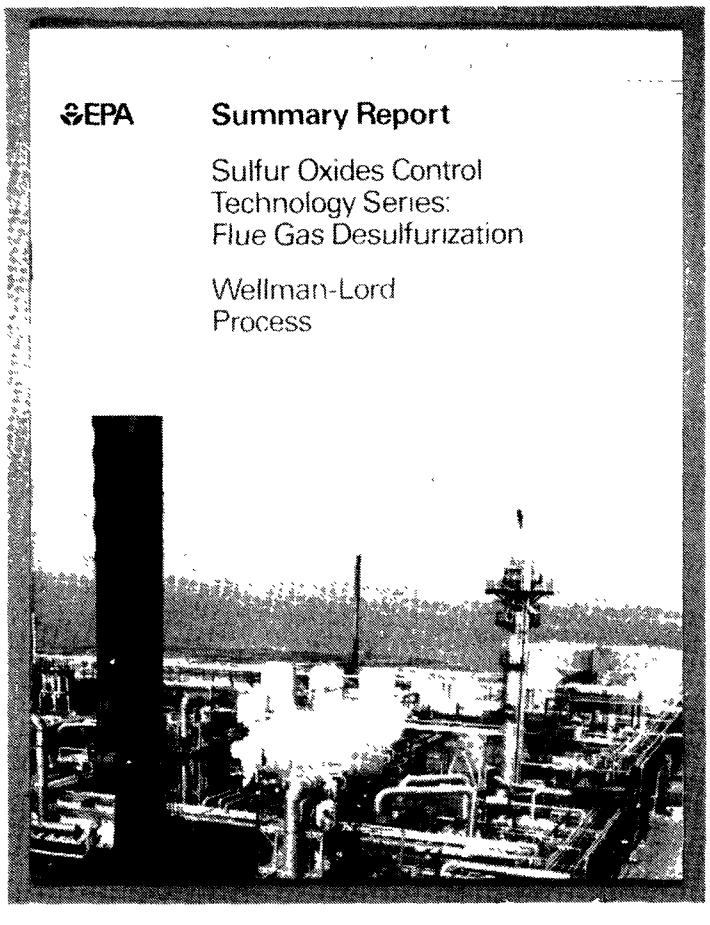
ERIC Initiates New Publication: Summary Report

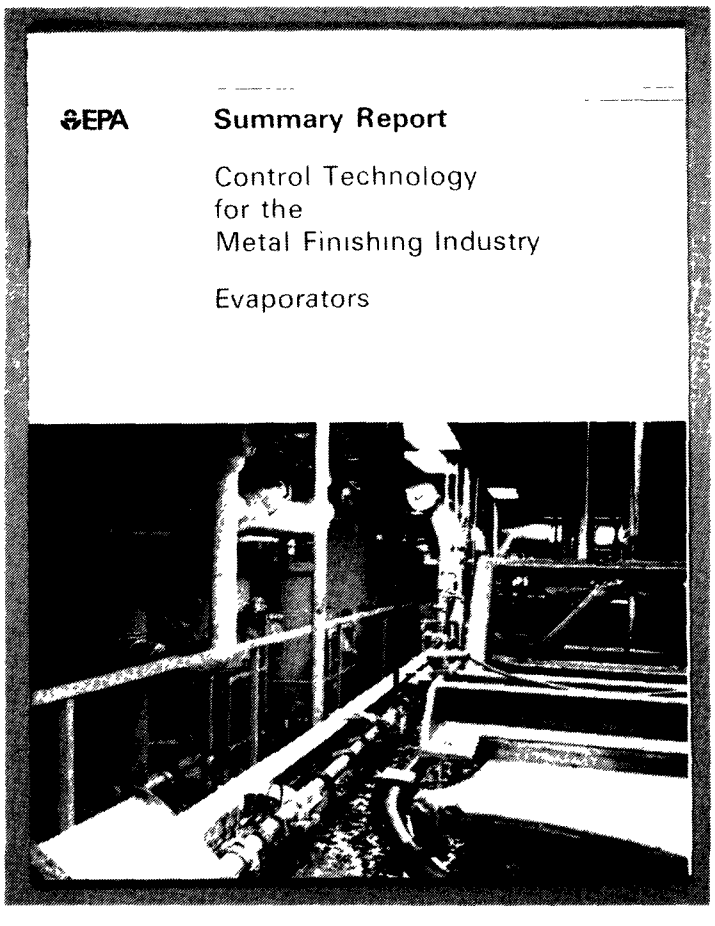
A Technology Transfer summary report series of publications has been initiated by the Environmental Research Information Center for the purpose of aggregating information regarding particular environmental pollution problems. Subareas of a subject or "problem" will be addressed in individual reports, presenting a comprehensive, yet concise compilation of information on a particular topic

Two report series have now been initiated with the recent publication of summary reports: "Sulfur Oxides Control Technology: Flue Gas Desulfurization, The Wellman-Lord Process" and "Control Technology for the Metal-Finishing Industry: Evaporators."

The Wellman-Lord Process report and future reports in this Sulfur Oxide Series, such as lime/limestone and magnesium oxide FGD processes, are funded by the Industrial Environmental Research Laboratory; Research Triangle Park and explain methods for controlling sulfur dioxide emissions. The Wellman-Lord report describes design and environmental considerations, present status, raw material and utility requirements, costs, and installation space required for the process. This report can be ordered by checking the appropriate box (#8001) on the order form on the back of this Newsletter.

The Evaporators report and future reports in the Metal-Finishing Series, such as reverse osmosis and ion exchange, are funded by the Industrial Environmental Research Laboratory in Cincinnati. This initial report describes the technical and economic advantages, operating costs, and cost-savings benefits for evaporators used in electroplating processes. To order the Evaporators report, check the appropriate box (#8002) on the back of this Newsletter.





Additional Small Flows Seminars to be Conducted

Five Technology Transfer seminars on "Wastewater Treatment Facilities for Small Communities" will be conducted this year. These seminars will be held in Phoenix, Arizona, July 17-19, 1979; Portland, Oregon, July 31-August 2, 1979; Omaha, Nebraska, August 14-16, 1979; Indianapolis, Indiana, August 28-30, 1979; and New Orleans, Louisiana, September 18-20, 1979. Although seminars on this subject have previously been conducted, this year's seminars will feature two new four-hour sessions: "Management of On-Site Systems" and "Methodology for Alternatives Analysis." These sessions will be particularly helpful for those preparing facility plans and/or developing an on-site management program.

Individuals wishing to attend the Phoenix, Portland, Omaha, or New Orleans seminars should write to:

USEPA
c/o Enviro Control, Inc.
P.O. Box 828
Rockville, MD 20851

Those wishing to attend the Indianapolis seminar should write to:

USEPA
Attn: Marti Velasco, Water Division
230 South Dearborn Street
Chicago, IL 60604

Workshop on the Use of Nonpoint Source Pollution Assessment Models

The Environmental Research Information Center, in cooperation with the Environmental Research Laboratory in Athens, Georgia, presented a second workshop on the use of models for the assessment of soluble and suspended pollutants from agricultural and rural lands held May 1-3, 1979 in Chicago, Illinois.

The Agricultural Runoff Management (ARM) and the Nonpoint Source (NPS) models for determing pollutant loads in surface water runoff were discussed. The NPS model is designed for continuous simulation of pollutants in surface water runoff from five different land use categories. The ARM model is designed to simulate the continuous runoff of pesticides, sediments and nutrients from rowcrop agricultural lands.

The workshop presented the structure and organizaton of the models, input description and preparation requirements such as the algorithm and parameter processes for hydrology, sediment, nutrients, pesticides, and land use categories. In addition, parameter estimation and calibration of the models were discussed.

EPA Research Reports, EPA-600/3-78-080 and EPA-600/3-77-065, describing the use of these models, are available on a limited basis through:

Technical Information Operations Staff
USEPA
Cincinnati, OH 45268

Technical information and assistance on use of these models is available through.

Environmental Research Laboratory
U.S. Environmental Protection Agency
College Station Road
Athens, GA 30605

Second Workshop on Water Quality Screening Methodology

The Environmental Research Information Center and the Environmental Research Laboratory, Athens, Georgia, are sponsoring a three-day workshop on water quality assessment techniques for estimating pollutant levels from point and nonpoint sources and for evaluating their effect on water quality in streams and reservoirs. The workshop, to be held in Chicago, Illinois, November 7-9, 1979 is intended for engineers and planners who are involved in evaluating surface water quality in Section 208 nondesignated areas.

The workshop will present techniques that are included in the manual, "Water Quality Assessment: A Screening Method for Nondesignated 208 Areas" (EPA-600/9-77-023), which was developed under contract by the Office of Research and Development's Athens laboratory. This screening method involves several simplified techniques and, in most cases, can be accomplished with the assistance of a desk-top calculator. The methodology is intended to be used with little external or collected input; instead, tables, figures, and appendices of the manual provide much of the working data.

If you are interested in attending this workshop, contact Orville Macomber, Environmental Research Information Center, (513) 684-7394.

The manual is available on a limited basis from:

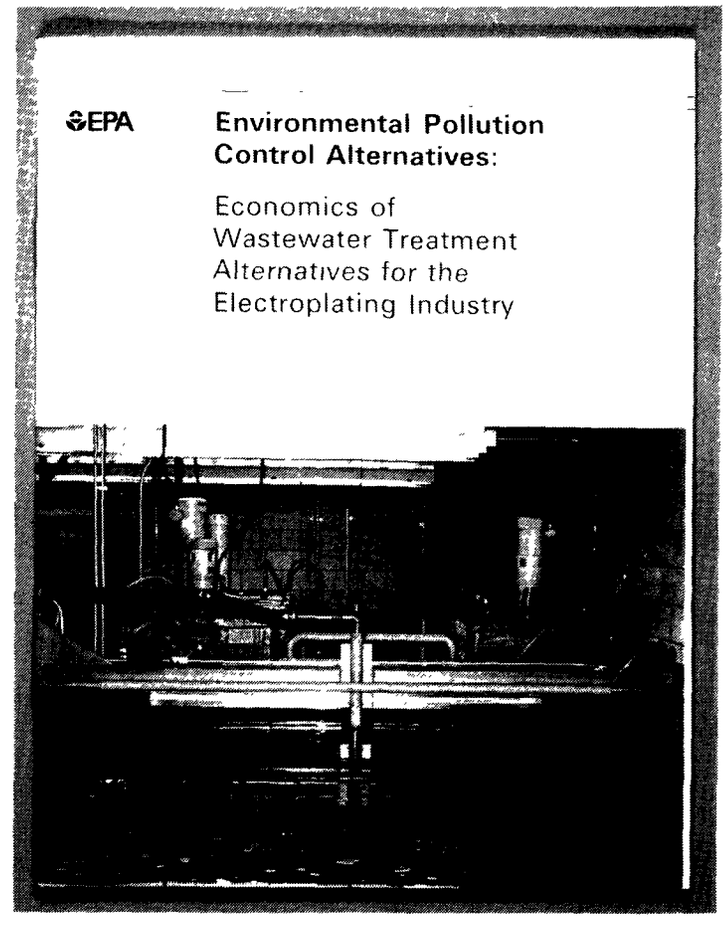
Technical Information Operations Staff
USEPA
Cincinnati, OH 45268

New Environmental Pollution Control Alternatives Publication for Electroplating Industry

The Environmental Research Information Center has published a new Technology Transfer Environmental *Pollution Control Alternatives brochure entitled, "Economics of Wastewater Treatment Alternatives for the Electroplating Industry."*

This brochure, funded by the Industrial Environmental Research Laboratory (Metals and Inorganic Chemicals Branch) in Cincinnati, Ohio, addresses the economics of various techniques for meeting water pollution control requirements as a guide for minimizing costs. Operating and investment costs of conventional wastewater treatment systems are compared with alternative treatment technologies, manufacturing process changes and pollution control device modifications that may offer cost savings.

The Alternatives series of publications is directed to the reader with technical and managerial responsibilities in local, state or federal government and private industry who is involved in finding solutions to environmental problems. To order, check the appropriate box (#5016) on the order form at the back of this Newsletter.



Seminar Series Ends—Air Pollution Equipment

The Technology Transfer seminar series on "Operation and Maintenance of Air Pollution Equipment for Particulate Control" was completed in June. The three seminars held in Atlanta, Georgia; Arlington, Virgina; and San Francisco, California drew a combined total of over 500 participants, comprised primarily of persons who are either responsible for equipment performance or who operate the hardware.

This series was presented by the Environmental Research Information Center and was co-sponsored by *Pollution Engineering,* a major international environmental magazine.

The seminars provided discussions on guidelines and practical solutions to equipment problems by representatives of control systems manufacturers and engineers from various industries where these systems are used.

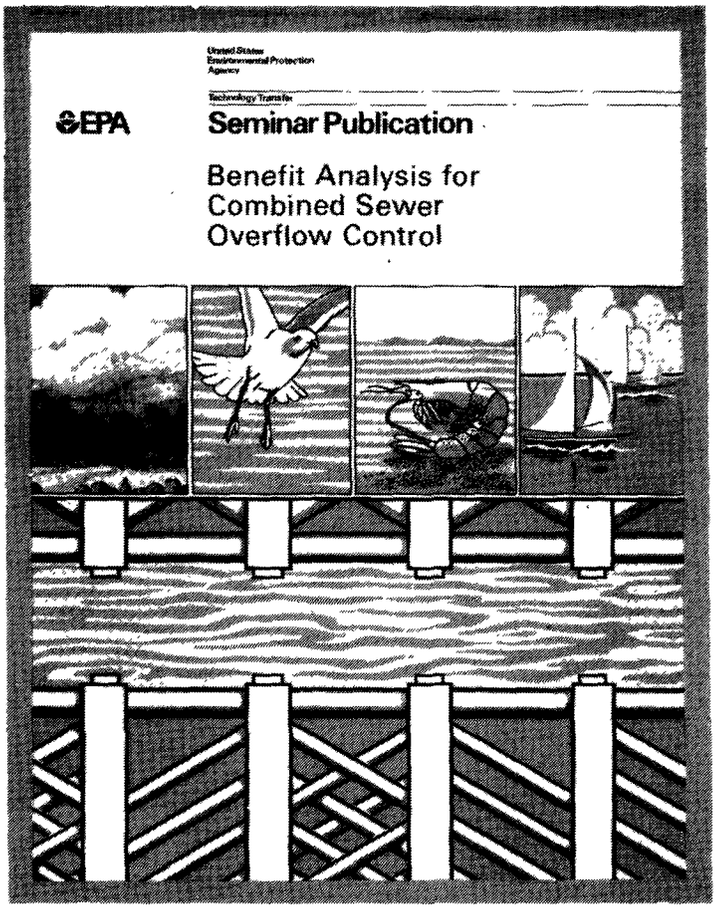
Four speakers from O&M Seminar in San Francisco: (upper left, clockwise) Heinz Engelbrecht, Richard McRanie, Robert Bump, Robert Wright.

New Seminar Publication: Benefit Analysis for Combined Sewer Overflow Control

A new publication has been developed from the Technology Transfer seminar series "Combined Sewer Overflow Assessment and Control Procedures," which was presented in 1978. This publication is intended for the use of elected officials of municipalities, their technical staff members and consultants, and state and federal government employees who have review and approval authority for combined sewer overflow (CSO). The information in this publication will be of help to any municipality in providing guidance to avoid numerous and costly pitfalls and to take full advantage of opportunities for assistance in planning and implementing a combined sewer overflow control program.

This publication includes sections on legislation and regulations relating to CSO projects, objectives for planning, methods for relating pollutant sources to beneficial uses, engineering alternatives and costs for controlling CSO's, and case studies that present methods used for assessment.

This publication can be obtained by checking the appropriate box (#4013) on the order form at the back of this Newsletter



Symposium on Wastewater Aerosols and Disease

The Health Effects Research Laboratory in Cincinnati, Ohio is sponsoring a symposium on the transmission of disease agents by aerosols from wastewater treatment facilities. This symposium will be held September 18-21 at Stouffer's Cincinnati Towers Hotel in Cincinnati. Scientists, engineers, physicians and federal, state and local health officials will review information on aerosol contaminants and their effects on exposed populations. The symposium will conclude with a panel discussion assessing the problems and alternative solutions, as identified, and define continuing research needs in the context of regulatory and enforcement needs

For information concerning the workshop, contact Doug Williams, Environmental Research Information Center, (513) 684-7394.

To register to attend the workshop, contact:

Virginia Hathaway
JACA Corporation
550 Pinetown Road
Fort Washington, PA 19034
(215) 643-5466

Proceedings of National Conference on Lake Restoration

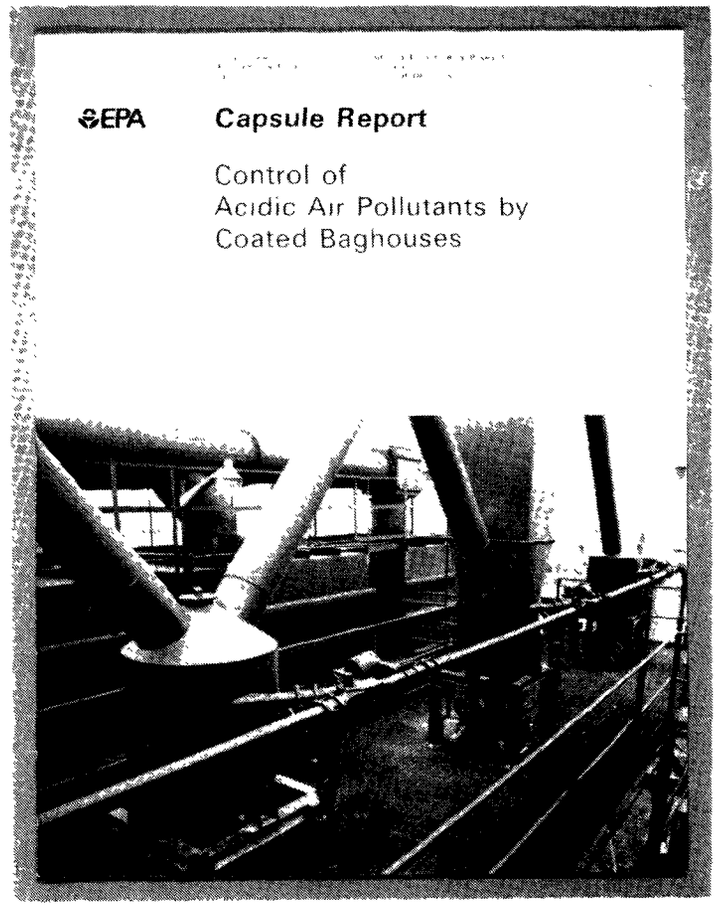
The "Proceedings of the National Conference on Lake Restoration," held August 22-24, 1978 in Minneapolis, Minnesota, have been published and can be ordered. The conference was jointly sponsored by the Minnesota Pollution Control Agency and EPA's Office of Water Planning and Standards along with the Environmental Research Information Center. Over 450 people representing 39 states and a wide range of disciplines were in attendance. The Proceedings include 34 conference presentations on topics such as federal, state and local programs assessing lake restoration problems, alternative solutions, in-lake treatment methods, and state-of-the-art research.

To obtain a copy of the Proceedings or information regarding EPA's lake restoration program contact:

Robert Johnson (WH-585)
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, DC 20460

New Capsule Report: Control of Acidic Air Pollutants by Coated Baghouse

Emissions from the aluminum, glass, phosphate, fertilizer, and sulfuric acid industries and from waste incineration have exhaust gas characteristics unique to their sources However, they also share several common problems, including combined particulate, corrosive acid vapor, and acid mist emissions. This Technology Transfer Capsule Report presents an approach to alleviate these problems through the use of dry scrubbing to neutralize and capture the acids, followed by removal of particulates and captured acids in a baghouse filter. To receive a copy, check the appropriate box (#2020) on the order form at the back of this Newsletter.



Hydrocarbon Seminar Series is Successful

Over 700 participants attended three Technology Transfer seminars on "Volatile Organic Compound Control in the Surface Coating Industries." This series was sponsored by the Environmental Research Information Center, the Air Pollution Control Association, the Association of Finishing Processors, and the National Paint and Coatings Association, in an effort to acquaint participants with new regulations requiring the reduction of volatile organic compound (VOC) emissions The seminar presentations included explanation of these regulations and descriptions of low-solvent coating technology with respect to the VOC emission limits, add-on air pollution control equipment capabilities and engineering changes, and plant survey and enforcement information

Environmental Research Information Center
1979 Seminar Schedule

Technology Transfer Scheduled Events

In order to keep you more aware of future Technology Transfer activities (particularly seminars), the following schedule is included. Should you desire more details on any of the activities listed, contact the appropriate Technology Transfer Regional Chairman listed in this newsletter.

Subject	Date	Region/Location	
Innovative and Alternative Technology (I/A)	August 6-7, 1979	4	Atlanta
I/A	August 9-10, 1979	1	Boston
I/A	August 27-28, 1979	10	Seattle
I/A	September 10-11, 1979	5	Chicago
I/A	September 20-21, 1979	2	New York
I/A	September 27-28, 1979	7	Kansas City
I/A	October 22-23, 1979	3	Philadelphia
I/A	December 3-4, 1979	8	Denver
I/A	December 6-7, 1979	9	Los Angeles
Small Flows	August 14-16, 1979	7	Omaha
Small Flows	August 28-30, 1979	5	Indianapolis
Small Flows	September 18-20, 1979	6	New Orleans
Water Quality Screening Workshop	November 7-9, 1979	5	Chicago

REQUEST FOR TECHNOLOGY TRANSFER MATERIAL

The publications listed on this form are the only ones available through the Office of Technology Transfer.
(Check appropriate boxes)

PROCESS DESIGN MANUALS

- Phosphorus Removal (April 1976) 1001 ☐
- Carbon Adsorption (Oct 1973) 1002 ☐
- Suspended Solids Removal (Jan 1975) 1003 ☐
- Upgrading Existing Wastewater Treatment Plants (Oct 1974) 1004 ☐
- Sulfide Control in Sanitary Sewerage Systems (Oct 1974) 1005 ☐
- Sludge Treatment and Disposal (Oct 1974) 1006 ☐
- Nitrogen Control (Oct 1975) 1007 ☐
- Land Treatment of Municipal Wastewater (Oct 1977) 1008 ☐
- Wastewater Treatment Facilities for Sewered Small Communities (Oct 1977) 1009 ☐
- Municipal Sludge Landfills (Oct 1978) 1010 ☐

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 ☐
- Second Progress Report Lime/Limestone Wet-Scrubbing Test Results at the EPA Alkali Scrubbing Test Facility 2008 ☐
- 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 ☐

INDUSTRIAL SEMINAR PUBLICATIONS

- Upgrading Poultry Processing Facilities to Reduce Pollution (3 Vols) 3001 ☐
- Upgrading Metal Finishing Facilities to Reduce Pollution (2 Vols) 3002 ☐
- Upgrading Meat Packing Facilities to Reduce Pollution (3 Vols) 3003 ☐
- Upgrading Textile Operations to Reduce Pollution (2 Vols) 3004 ☐
- Choosing the Optimum Financial Strategies for Pollution Control Systems 3005 ☐
- Erosion and Sediment Control — Surface Mining in the Eastern U S (2 Vols) 3006 ☐
- Pollution Abatement in the Fruit and Vegetable Industry (3 Vols) 3007 ☐
- Choosing Optimum Management Strategies 3008 ☐
- Controlling Pollution from the Manufacturing and Coating of Metal Products (3 Vols) 3009 ☐

MUNICIPAL SEMINAR PUBLICATIONS

- Upgrading Lagoons 4001 ☐
- Physical-Chemical Wastewater Treatment Plant Design 4002 ☐
- Status of Oxygen/Activated Sludge Wastewater Treatment 4003 ☐
- Nitrification and Denitrification Facilities 4004 ☐
- Upgrading Existing Wastewater Treatment Plants — Case Histories 4005 ☐
- Flow Equalization 4006 ☐
- Wastewater Filtration 4007 ☐
- Physical-Chemical Nitrogen Removal 4008 ☐
- Air Pollution Aspects of Sludge Incineration 4009 ☐
- Land Treatment of Municipal Wastewater Effluents (3 Vols) 4010 ☐
- Alternatives for Small Wastewater Treatment Systems (3 Vols) 4011 ☐
- Sludge Treatment and Disposal (2 Vols) 4012 ☐
- ● Benefit Analysis for Combined Sewer Overflow Control 4013 ☐

BROCHURES

- Environmental Pollution Control Alternatives Municipal Wastewater 5012 ☐
- Forest Harvesting and Water Quality 5013 ☐
- Irrigated Agriculture and Water Quality Management 5014 ☐
- Forest Chemicals and Water Quality 5015 ☐
- ● Environmental Pollution Control Alternatives Economics of Wastewater Alternatives for the Electroplating Industry 5016 ☐

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

- Environmental Considerations of Energy — Conserving Industrial Process Changes 9001 ☐
- Environmental Sampling of Paraho Oil Shale Retort Process 9002 ☐

ATTENTION PUBLICATION USERS

Due to the increasing costs of printing and mailing, it has become necessary to institute positive management controls over distribution of Technology Transfer publications. Although these publications *will be distributed on a no-cost basis*, any request for more than five documents total or for more than one copy of a single document must be accompanied by written justification, preferably on organization letterhead. In the event your order cannot be filled as requested you will be contacted and so advised.

If you are not currently on the mailing list for the Technology Transfer Newsletter, do you want to be added? Yes ☐ No ☐

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Note Foreward to ERIC, Technology Transfer, U S Environmental Protection Agency, Cincinnati, OH 45268

Where to Get Further Information

In order to get details on items appearing in this publication, or any other aspects of the Technology Transfer Program, contact the EPA Regional Technology Transfer Committee Chairman in your region

REGION	CHAIRMAN	ADDRESS
1	Lester Sutton	Environmental Protection Agency John F Kennedy Federal Building Room 2313 Boston, Massachusetts 02203 617 223-2226 (Maine, N H , Vt , Mass , R I , Conn)
2	Robert Olson	Environmental Protection Agency 26 Federal Plaza New York, New York 10007 212 264-1867 (N Y , N J , P R , V I)
3	Albert Montague	Environmental Protection Agency 6th & Walnut Streets Philadelphia, Pennsylvania 19106 215 597-9856 (Pa , W Va , Md , Del , D C , Va)
4	Asa B Foster, Jr	Environmental Protection Agency 345 Courtland Street, N E Atlanta, Georgia 30308 404 881-4450 (N C , S C , Ky , Tenn , Ga , Ala , Miss , Fla)
5	Clifford Risley	Environmental Protection Agency 230 S Dearborn Street Chicago, Illinois 60604 312 353-4625 (Mich , Wis , Minn , Ill , Ind , Ohio)
6	Mildred Smith	Environmental Protection Agency 1201 Elm Street First National Building Dallas, Texas 75270 214 767-2697 (Texas, Okla , Ark , La , N Mex)
7	Charles M Hajinian	Environmental Protection Agency 324 East 11th Street Kansas City, Missouri 64106 816 374-2921 (Kansas, Nebr , Iowa, Mo)
8	Elmer Chenault	Environmental Protection Agency 1860 Lincoln Street Denver, Colorado 80295 303 837-2277 (Colo , Mont , Wyo , Utah, N D , S D)
9	Fred Hoffman	Environmental Protection Agency 215 Fremont Street San Francisco, California 94105 415 556-6925 (Calif , Ariz , Nev , Hawaii)
10	John Osborn	Environmental Protection Agency 1200 6th Avenue Seattle, Washington 98101 206 442-1296 (Wash , Ore , Idaho, Alaska)

USEPA - OR&D
Environmental Research Information Center
26 W St Clair Street
Cincinnati, Ohio 45268
513 684-7394—7398 (Inc)

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