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Environmental Protection
Agency

Center for Environmental Research
Information
Cincinnati OH 45268

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October 1979

EPA TECHNOLOGY TRANSFER

The Bridge Between
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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

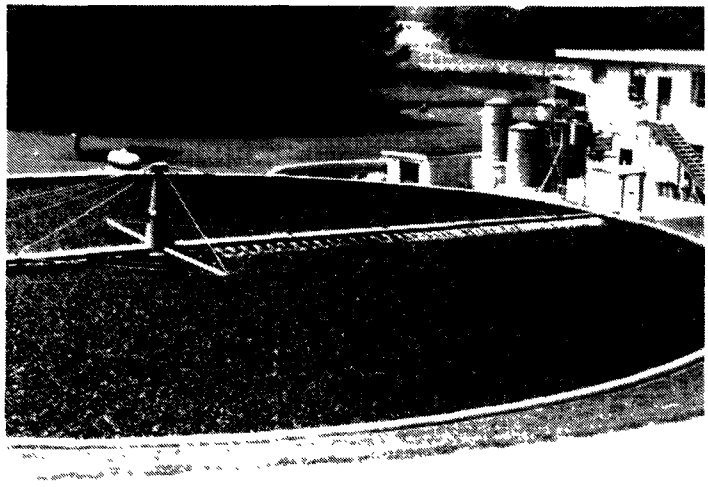
The initial phase of study for the program has now been completed and results from this two-plant investigation have been published (EPA-440/1-79-300) and are available at the Water Pollution Control Federation Conference through the Effluent Guidelines Division, booth 2300, and from the Center for Environmental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

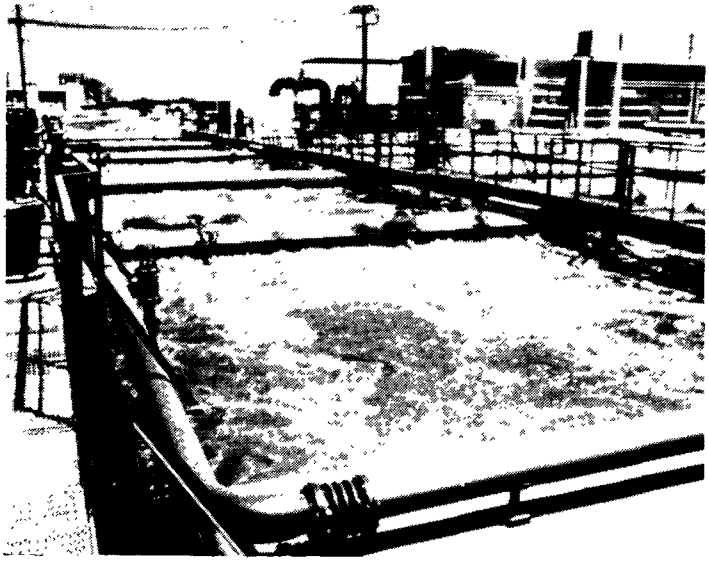
Publication Update: Municipal Wastewater Alternatives

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.



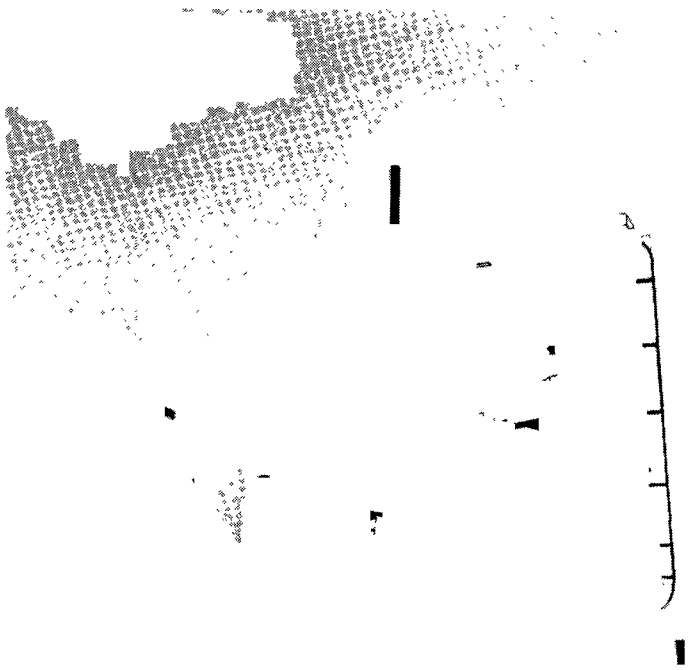
Trickling Filter

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

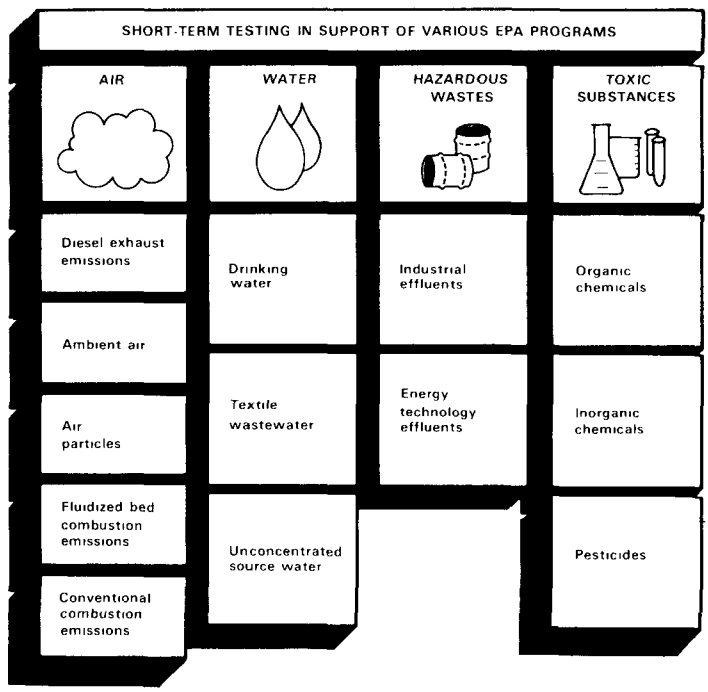
The Bahco System at Rickenbacker Air Force Base

ew Environmental Assessment eport on Short-Term Testing

ıe Center for Environmental Research Information has ublished the first of a new series of Technology Transfer ports on "Environmental Assessment." This series is mewhat different from other Technology Transfer publiations in that the topics, rather than focusing on control chnology or environmental engineering, will deal with sues involving toxic substances and their effects on uman health and the environment. Since much of the gency's effort and resources are now directed to regula-ıg the release of toxic chemicals into the environment, e "Assessment" series was developed to provide a eans for collecting and disseminating the information volving from this effort. These reports are intended for an udience whose chief concern is protection of human ealth

ıe first report in the series is entitled, "Short-Term Tests ır Carcinogens, Mutagens and Other Genotoxic Agents." ıort-term tests are techniques developed to serve as ıpid and relatively inexpensive predictors of a chemical's otential to alter genetic material. The report describes the ay in which short-term tests contribute to toxic material fects assessment. The scientific basis for and techniques sed in the tests, as well as current applications and search 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

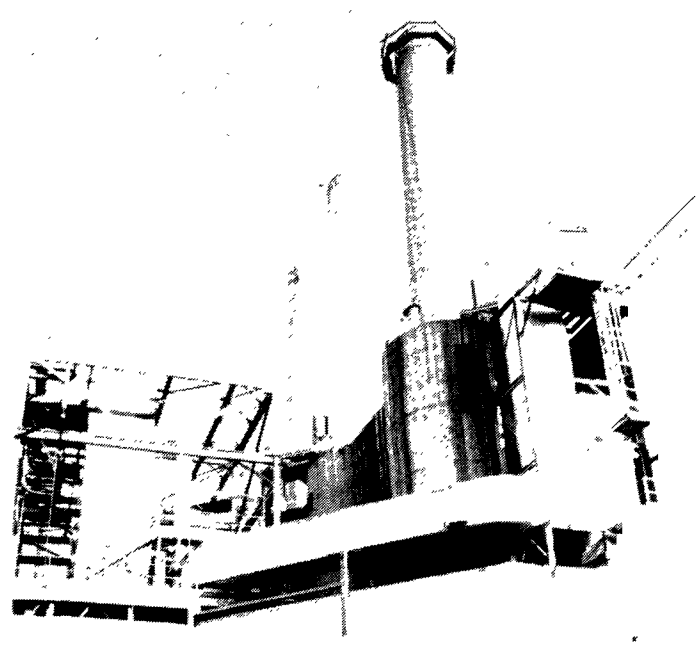
To date, five Technology Transfer Seminars on "Wastewater Treatment Facilities for Small Communities"have been presented in 1979: Phoenix, Arizona, July 17-19; Portland, Oregon, July 31 - August 2; Omaha, Nebraska, August 14-16; Indianapolis, Indiana, August 28-30; and New Orleans, Louisiana, September 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 actu administrative and operational practices utilized in sever communities and states. Among the case studi discussed are Fairfax County, Virginia; Lake Mead Pennsylvania; Otter Tail County, Minnesota; Stinsc Beach, California; and the State of Maryland.

The planning session, presented by James Hudso Patricia Deese and Robert McMahon of Urban Syster Research and Engineering, Inc., Cambridge, Massachi setts, and James Lake and Robert Williams of the Nation Association of Conservation Districts, Washington, D.C included information designed to aid engineers and th small communities they serve in applying and evaluatir various methods for wastewater management. Th information is intended to impact the early steps in th planning process, particularly the preapplication ar facility planning (step 1) stages of the construction gran program. Major topics addressed at the seminar wer institutional and regulatory setting; the application pr cess; development of a community profile; technic problem identification and generation and evaluation 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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July 1979

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.

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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 o

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 understandabl process control information to operators by desig engineers and technical assistance sources. Suc information should be included in the plant opera tion and maintenance manual, which in turr should reference other manuals provided throug. state and federal government for augmentatior and clarification of theory as necessary.

   c. Hold persons who disseminate operations techni cal guidance accountable for their recommenda tions. As a minimum, follow-up phone calls o plant visits should be used to determine if recom mendations given *were correct* and *still apply.*

4. Studies to determine the sources of plant perform ance problems should be comprehensive in orde that subtle as well as obvious factors which limi performance are identified. The performance poten tial of an existing plant should be verified by con ducting a comprehensive evaluation to identify al factors limiting performance. Plant administrator should be informed of the CCP approach to improvinç plant performance as an alternative to constructior 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 encour age optimum performance from existing facilities

   b. Require that CCP's be implemented prior to or ir conjunction with construction of new or modifiec facilities to insure that existing facilities' capabil ities are examined and optimized before unneedec construction is begun.

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

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

— "Evaluation of Operation and Maintenance Factors Limiting Municipal Wastewater Treatment Plan 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."

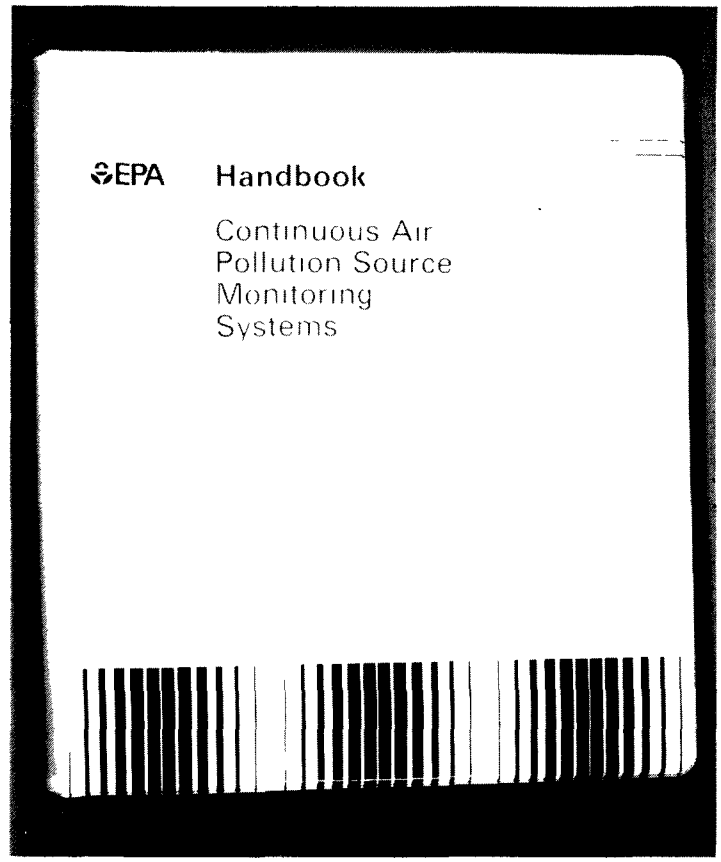
These seminars were held in Des Plaines, Illinois, Atlanta, Georgia; Boston, Massachusetts, Phoenix, Arizona; and Boise, Idaho. Subjects discussed included land treatment systems; slow rate, high rate, and overland flow; health aspects; management and monitoring options; development of public relations 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

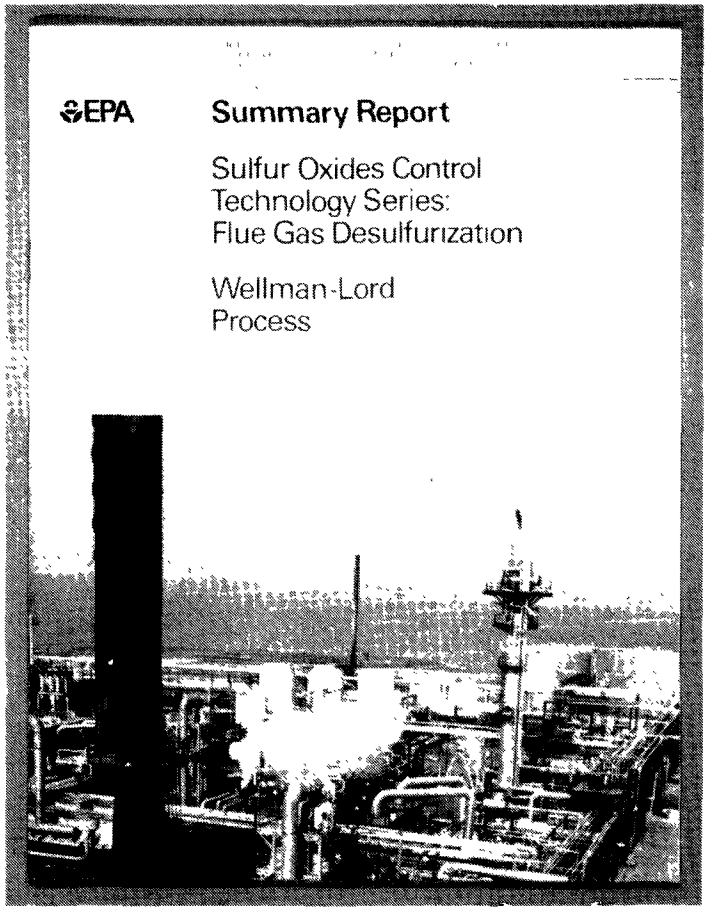
ERIC Initiates New Publication: Summary Report

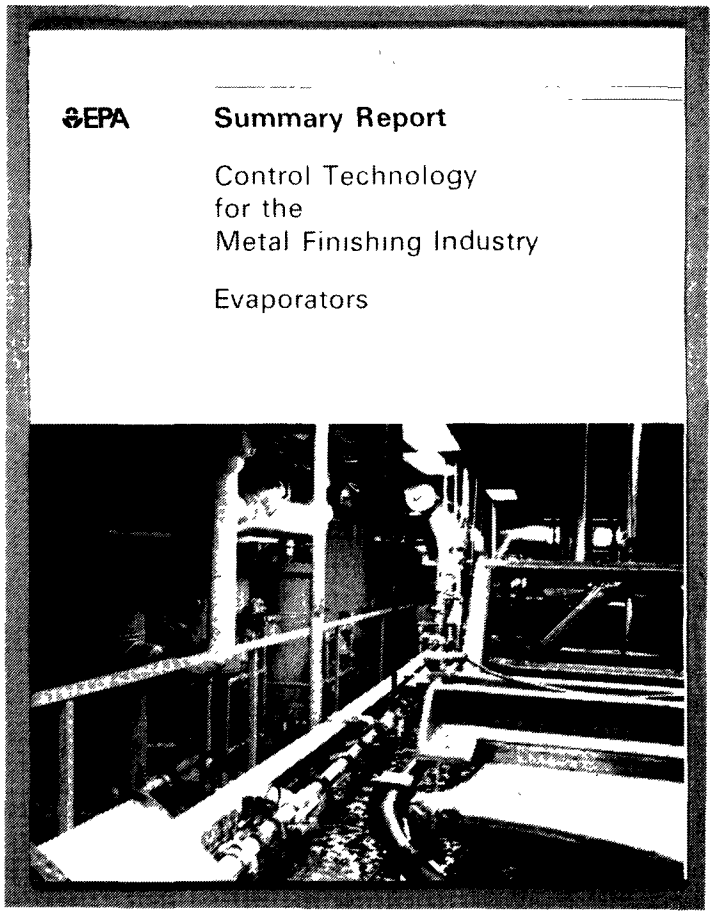
A Technology Transfer summary report series of publications has been initiated by the Environmental Research Information Center for the purpose of aggregating information regarding particular environmental pollution problems. Subareas of a subject or "problem" will be addressed in individual reports,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

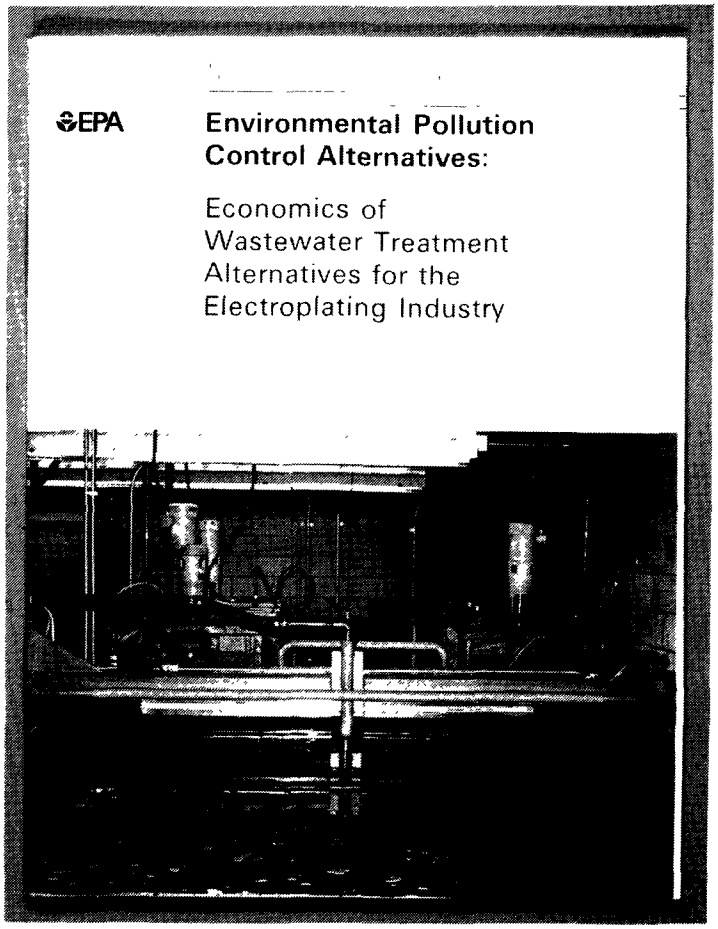
Technical Information Operations Staff
USEPA
Cincinnati, OH 45268

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

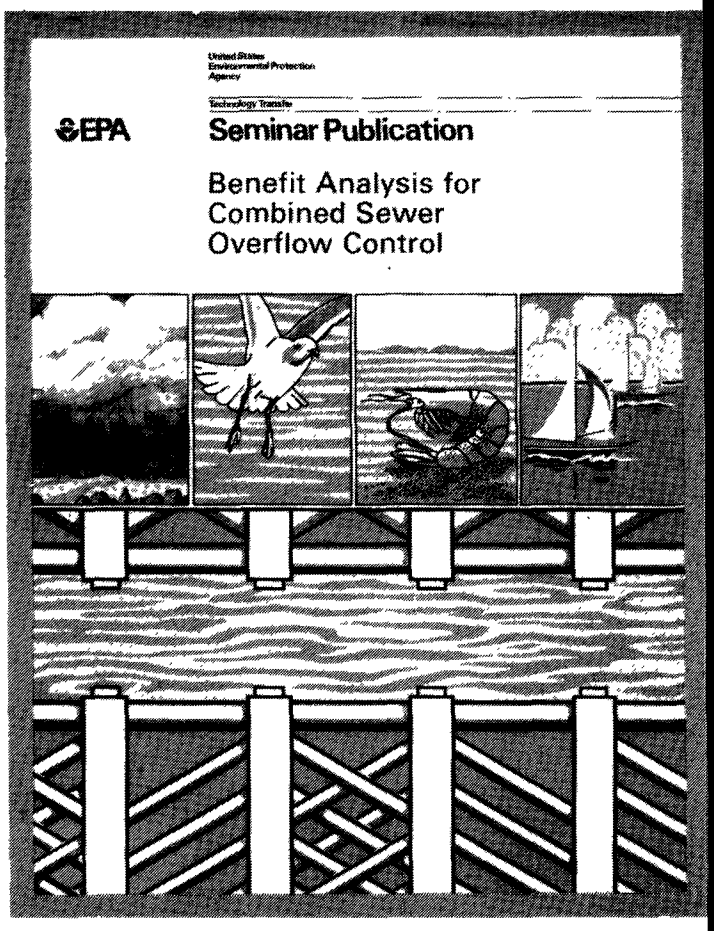
Four speakers from O&M Seminar in San Francisco: (upper left, clockwise) Heinz Engelbrecht, Richard McRanie, Robert Bump, Robert Wright.

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

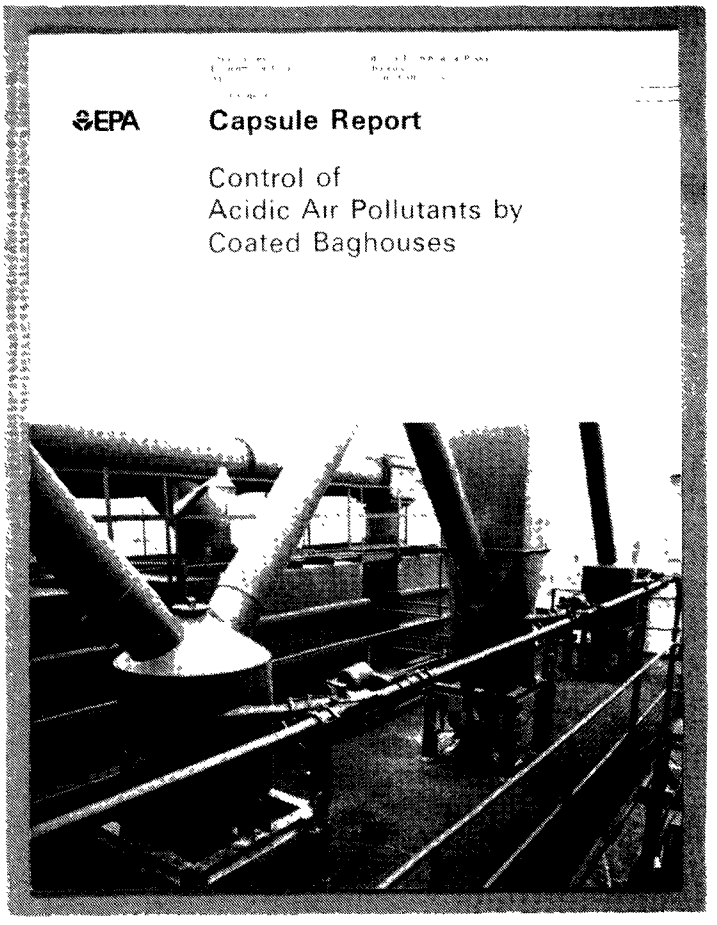
The "Proceedings of the National Conference on Lake Restoration," held August 22-24, 1978 in Minneapolis, Minnesota, have been published and can be ordered. The conference was jointly sponsored by the Minnesota Pollution Control Agency and EPA's Office of Water Planning and Standards along with the Environmental 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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Employer _____

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*It is not necessary to fill in this block if your name and address on reverse are correct

● Publication listed for the first time

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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March 1979

EPA TECHNOLOGY TRANSFER

The Bridge Between Research and Use

Successful 1978 WPCF Conference

The Water Pollution Control Federation held its 51st annual conference October 1-6, 1978, at the Convention Center in Anaheim, California. Almost 10,000 participants attended the 42 technical sessions, pre-conference workshops and exhibition. The display area featured exhibits from industry, professional groups, and for the ninth consecutive year, the Environmental Protection Agency.

This year, seven EPA programs combined forces to produce a single exhibit. Qualified agency personnel met and talked with conference attendees and distributed literature pertinent to each EPA program represented. The seven programs participating in this effort were:

(1) Environmental Research Information Center
(2) Effluent Guidelines
(3) Solid Waste
(4) Construction Grants
(5) Manpower and Training
(6) 208 Planning
(7) Operations and Maintenance

ERIC's Technology Transfer personnel distributed about 3000 copies of a process design manual entitled, "Municipal Sludge Landfills." The new manual provides comprehensive, up-to-date information to assist with planning, design and operation of a landfill receiving municipal wastewater treatment plant sludge.

The manual (#1010) can be ordered by returning the order form at the back of this newsletter.

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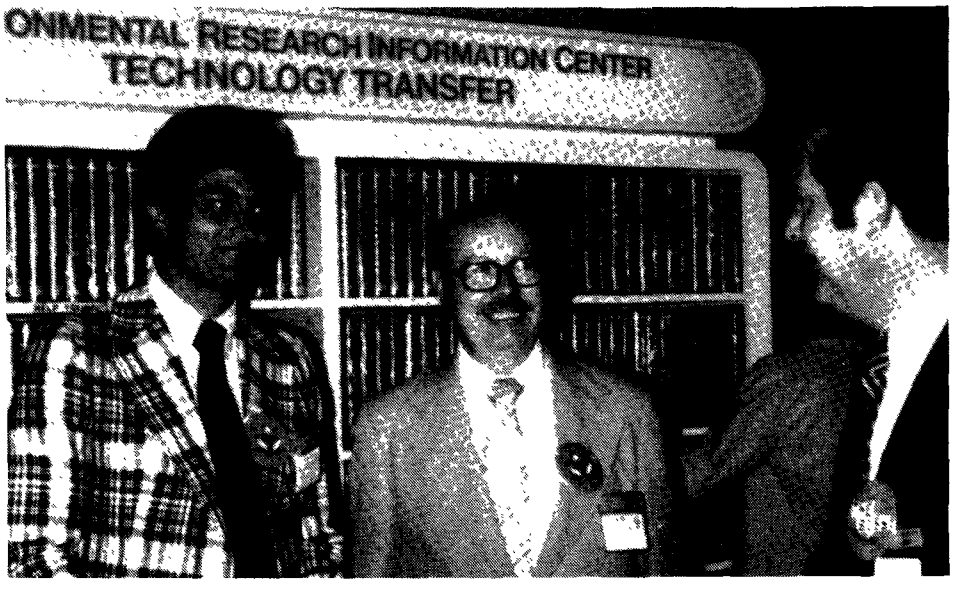


(L to R) Norm Kulujian, USEPA, ERIC; Clifford Risley, Region V, USEPA, Technology Transfer Chairman; and Douglas Costle, Administrator, USEPA, at the WPCF Conference.

Workshop on the Use of Nonpoint Source Pollution Assessment Models

A four-day workshop on the use of models for the assessment of soluble and suspended pollutants from agricultural and rural lands was held in Atlanta, Georgia, on October 23-27, 1978. The models discussed were the Agricultural Runoff Management (ARM) and the Nonpoint Source (NPS) models described in EPA research reports EPA-600/3-78-080 and EPA-600/3-77-065. These models were developed under contract by the Office of Research and Development's Environmental Research Laboratory located in Athens, Georgia.

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 nutrier from rowcrop agricultural lands.

The workshop discussed the structure and organization the models, input description and preparation requirements such as the algorithm and parameter processes f hydrology, sediment, nutrients, pesticides and land us categories. In addition, parameter estimation and calibr tion of the models was discussed.

Work groups were formed to apply the models to actu situations by utilizing case studies. Parameters were selected and simulation runs were made on a computer test the sensitivity of the models and to determine poll tant loads.

A second workshop is being planned for Chicago durir the first week in May 1979. If you are interested in atter ing this workshop, contact Orville Macomber, Environmental Research Information Center, (513) 684-7394.

Hydrocarbon Seminar Series to be Held This Spring

The Environmental Research Information Center will hold three seminars to assist surface coaters in complying with new regulations for reducing volatile organic compound (VOC) emissions. Many states have been required by the 1977 Clean Air Act Amendments to revise their state implementation plans (SIPs) for controlling VOCs in order to attain the ozone air quality standard. These require surface coaters to utilize reasonably available control technology (RACT), though in some states, notably California, surface coaters are required to achieve controls that are more stringent than RACT.

These seminars will present the technologies capable of meeting or exceeding the emission limits associated with RACT for surface coating industries. The Los Angeles seminar will also specify technologies capable of meeting the more stringent regulations of the California air pollution control districts.

The seminars are free and you may obtain a registration form by contacting Norm Kulujian, Environmental Research Information Center, (513) 684-7394. The dates for the seminars are:

- Valley Forge, Pennsylvania, March 29-30, 1979
- Chicago, Illinois, April 25-26, 1979
- Los Angeles, California, May 10-11, 1979

The material presented will explain the regulations, describe low-solvent coating technology with respect t the VOC emission limits, cover add-on air pollution cont equipment capabilities and engineering changes, and present plant survey data and information which will assist in compliance with regulations.

Three important aspects of the presented material are

- The environmental regulations will be explained with respect to different coating systems.
- Descriptions of low-solvent coating technolo and air pollution control equipment will quic focus in on their specific capabilities and limit tions for meeting industry-specific RACT or California emission limits.
- Small informal groups will be established f discussing compliance techniques for surfa coating industry RACT or California require ments.

The speakers at each seminar are experts in their fiel and have experience in surface coating industries. The will be ample time for interaction between industry an government speakers.

These seminars are being co-sponsored by the Societ of Manufacturing Engineer's Association of Finishing Processors, the National Paint and Coatings Associati and the Air Pollution Control Association.

Two of the three Technology Transfer Handbooks, *Analytical Quality Control in Water and Wastewater Laboratories* and *Methods for Chemical Analysis of Water and Wastes* are no longer available from the Environmental Research Information Center. These manuals are now available from: Shirley Graden, Environmental Monitoring and Support Laboratory, Cincinnati, OH 45268.

'orkshop on Water Quality Screening ethodology for Nondesignated)8 Areas

'our-day workshop presenting water quality assessment chniques for estimating pollutant loads from point and npoint sources and evaluating their effect on water ality in streams, reservoirs and estuaries was held in w Orleans, Louisiana, on November 27 through Decem- r 1, 1978. The workshop was designed to utilize the anual, "Water Quality Assessment: A Screening Method · Nondesignated 208 Areas" (EPA-600/9-77-023), nich was developed under contract by the Office of search and Development's Environmental Research boratory in Athens, Georgia.

is screening method is a simplified technique and in ost cases can be accomplished with the assistance of a sktop calculator. The methodology is intended to be used th little external or collected input; instead, tables, figures, and appendices of the manual provide much of the working data.

The workshop was divided into four one-day sessions with participants attending all sessions. The topics discussed were: (1) assessment of pollutant loading from point and nonpoint sources; (2) stream analysis for temperature, BOD, DO, TSS, coliforms, nutrients and conservative materials; (3) impoundment analysis for thermal stratification, sediment accumulation, phosphorus budget, eutrophication potential and hypolimnion DO; (4) estuarine analysis for classification, temperature, BOD, DO, turbidity, sediment accumulation and conservative materials.

A limited quantity of the manual used in this workshop is available. It can be secured by writing to:

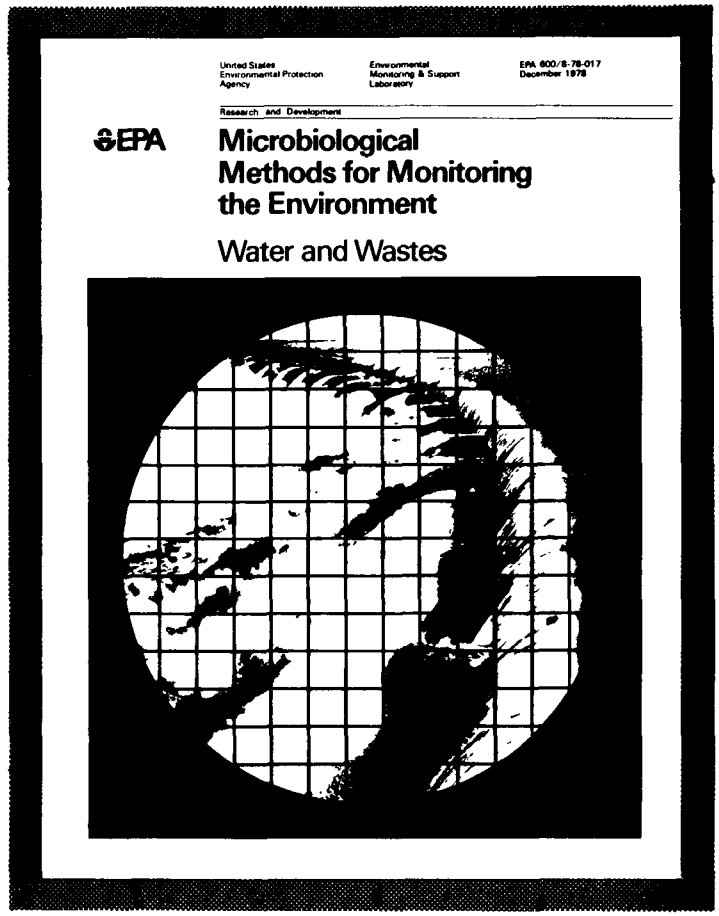
USEPA
Environmental Research Laboratory
College Station Road
Athens, Georgia 30605

ew EPA Manual Available: icrobiological Methods for onitoring the Environment — 'ater and Wastes

e first EPA manual on microbiology is now available. ited by R. H. Bordner and J. A. Winter of the Environ- ntal Monitoring and Support Laboratory (EMSL), ncinnati and P. Scarpino of the University of Cincinnati, s manual is intended for use by the supervisor or analyst no may be a professional microbiologist, technician, emist, engineer or plant operator. It provides uniform ld and laboratory methods recommended for use by alysts of waters and wastewaters in research, monitor- g, standard setting and enforcement activities. The thods are described in detailed stepwise form for the nch worker.

is manual covers coliform, fecal coliform, fecal reptococci, *Salmonella*, actinomycetes and Standard ate Count organisms with the necessary support ctions on sampling, equipment, media, basic microbio- gical techniques, safety, and quality assurance.

ngle copies are available on request from the Quality surance Branch, EMSL-Cincinnati, USEPA, Cincinnati, H 45268.



Air Pollution Equipment Operation and Maintenance Seminars

This new seminar series will provide guidelines and suggest solutions to commonly encountered problems in air pollution equipment operation and maintenance.

The seminar is designed to provide an effective interchange between the expert speakers and an audience of environmental managers and engineers in industry, industrial and utility plant personnel, equipment operators, air pollution consultants, and environmental agency personnel. Seminar sites and dates are listed below:

- Atlanta, Georgia — April 10-12, 1979
- Arlington, Virginia — May 14-16, 1979
- San Francisco, California — May 30-June 1, 1979

Morning sessions will be conducted by nationally recognized experts affiliated with leading equipment manufacturing companies. These speakers have extensive field experience in the design and operation of air pollution hardware.

Case histories discussing O&M aspects will be presented in the afternoon sessions by knowledgeable technical personnel in industries employing baghouses, electrostatic precipitators, and scrubbers. The final portion of each day will be allotted to a panel discussion with all speakers from that day present to answer questions asked by the attendees.

If you are interested in attending one of these seminars contact:

Norm Kulujian, Project Officer
U.S. Environmental Protection Agency
Cincinnati, OH 45268
Phone: (513) 684-7394

or

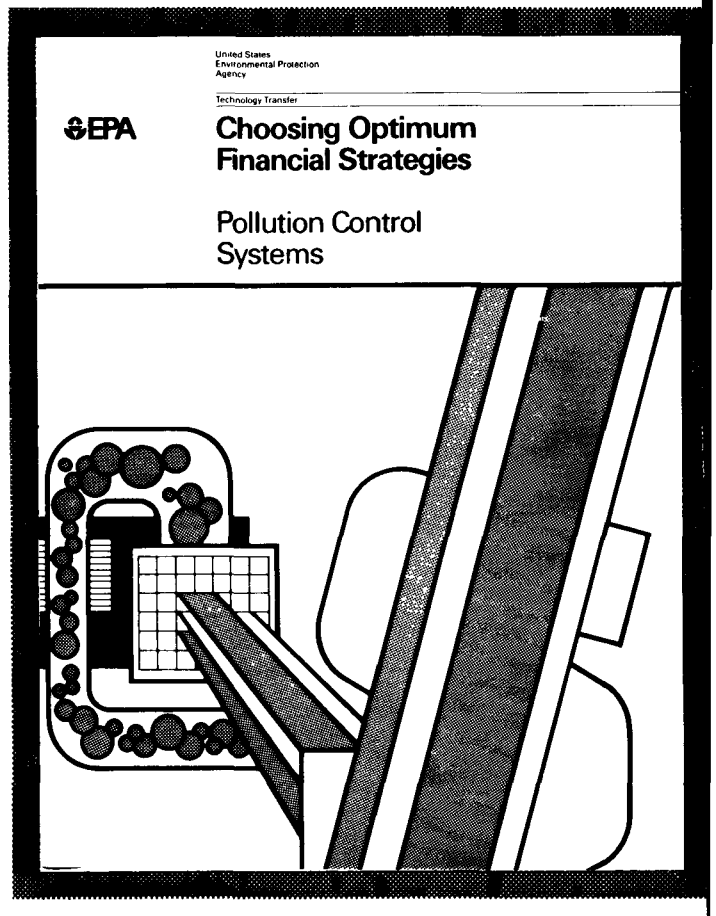
Frank Cross P.E., P.A.
Attn: Frank L. Cross, Jr., President
2713 Timberlake Drive
Orlando, FL 32806
Phone: (304) 857-0926

Seminar Publication Revised "Choosing Optimum Financial Strategies"

Originally published in June 1976, the industrial publication entitled, "Choosing Optimum Financial Strategies for Pollution Control Systems" has now been revised and is ready for distribution.

This publication is intended to alert decision makers to the availability of and qualifications for some of the financing incentives from federal, state, and local governments, and to demonstrate that it is well worth spending time analyzing the special methods of financing pollution control expenditures and the available tax treatments. Obtaining optimum financial and tax benefits could save a company tens of thousands of dollars over the life of the equipment. Included is a discussion of the tax and financing positions of three hypothetical firms with different management goals, but with similar capital expenditures for pollution control. A separate financial analysis is presented specifically for firms which have a choice of wastewater treated onsite or by a municipality.

For a copy of this publication (#3005), see the order form at the back of this newsletter.



oint Municipal and Industrial ›eminar Series on the Pretreatment f Industrial Wastes

en seminars on pretreatment of industrial wastes have een completed. Since the last newsletter, seminars were eld in Denver, Colorado, November 1-2, 1978; Boston, lassachusetts, November 14-15, 1978; Seattle, /ashington, December 5-6, 1978, and San Francisco, alifornia, December 7-8, 1978. Attendance was excel- ınt at each, going as high as 523 in Boston.

ince implementation of the pretreatment regulations equires close cooperation between industry and municipalities, representatives from both groups have comprised the audience for this series. The seminars contained two joint sessions to allow interaction between the two parties as well as a split session specifically formulated to present information unique to the industrial or municipal representative. Some of the topics presented were:

- Effluent Guidelines and Pretreatment Requirements
- Construction Grant Requirements
- Addressing the 65 Priority Pollutants
- *Establishing a Cost Effective Sludge Program*
- Minimizing Cost by Good Financial Management
- Establishing a Pretreatment Program

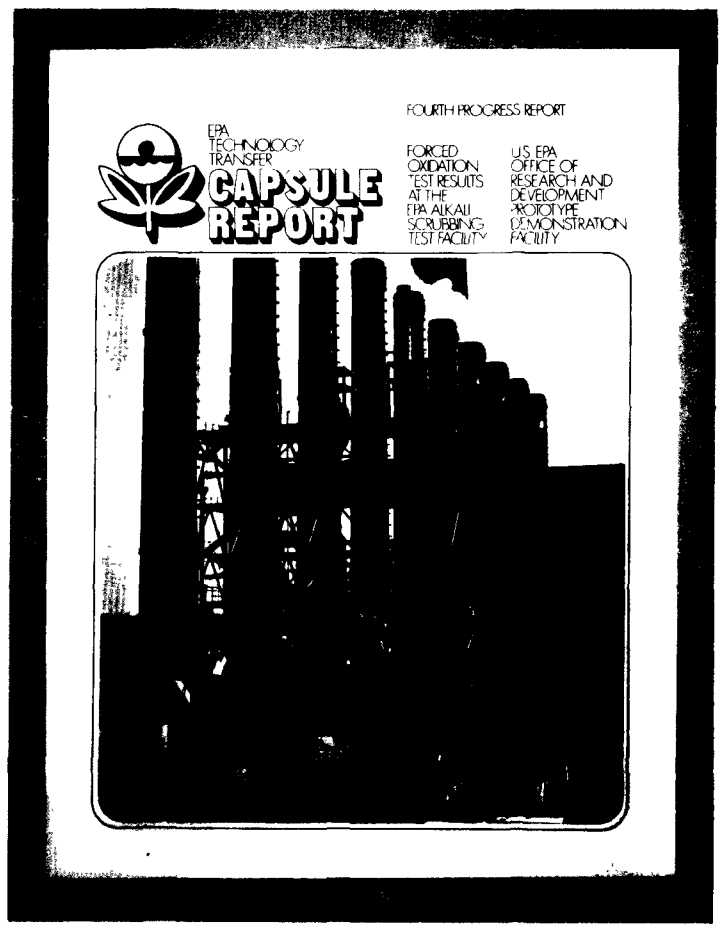
›apsule Report: Fourth Progress eport—Forced-Oxidation Test Results t the EPA Alkali Scrubbing Test Facility

his is the fourth in a series of capsule reports describing a rogram conducted by the Office of Research and Develop- ıent's Industrial Environmental Research Laboratory, esearch Triangle Park, North Carolina (IERL-RTP) to test rototype lime and limestone wet-scrubbing systems for emoval of sulfur dioxide and particulate matter (fly ash) om coal-fired boiler flue gases. This report discusses the esults of testing a forced-oxidation process designed to onvert calcium sulfite wastes, produced from lime and mestone wet-scrubbing systems, to material suitable for ndfill.

he use of flue gas desulfurization systems produces a /aste sludge containing calcium sulfite, calcium sulfate, nd collected fly ash. Calcium sulfite presents a serious isposal problem because of the difficulty of dewatering. hree processes have been considered to alleviate this roblem: (1) commercial fixation with additives, (2) blend- ıg sulfite sludge with fly ash, and (3) forced oxidation of ıe calcium sulfite to a more tractable calcium sulfate ypsum). The forced oxidation procedure was chosen for esting because of its anticipated economic advantages nd because it produces a waste sludge which is easily de- /atered to greater than 80 percent solids.

he tests are being conducted at the Tennessee Valley uthority (TVA) coal-fired Shawnee Power Station near aducah, Kentucky. Bechtel National, Inc. of San rancisco is the major contractor and test director and VA is the constructor and facility operator.

o request the capsule report (#2018), use the order form t the back of this newsletter.



ERIC Awards New Mailing Contract

Until recently, requests for Technology Transfer newsletters and publications were forwarded to a mailing contractor who processed and distributed these materials from the Washington, D.C., area. As of December 1978, a firm in Cincinnati, Ohio, has been performing these services.

The firm's ability to provide service has enabled them to acquire over 500 major accounts in the greater Cincinnati area, as well as function on national and international levels.

ERIC patrons who have had difficulty with our mailing services in the past can be assured of improved service in the future. . .now a four- to six-week turn around time can be expected from date of request to delivery of materials. Also, a new mailing label will appear on all packages received from ERIC. The label will designate: (1) contents within the package, (2) partial shipments, one asterisk, and (3) publications now available only from the National Technical Information Service, two asterisks.

The ERIC staff appreciates your patience and continued interest in our services.

Seminar Series Ends — Sludge Treatment and Disposal

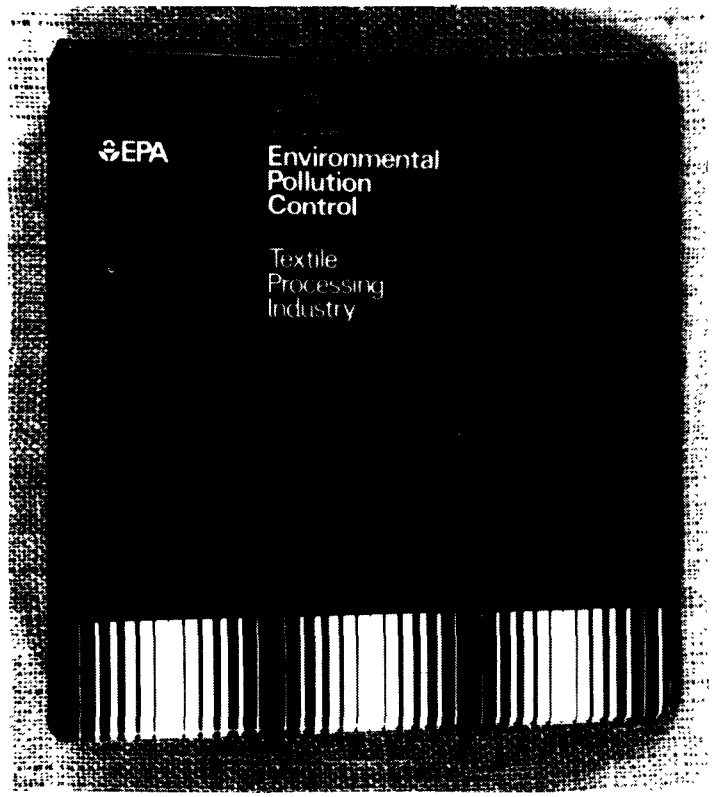
The last two in the series of Technology Transfer Municipal Design Seminars on Sludge Treatment and Disposal were held November 15-16, 1978, in Dallas, and December 12-13, 1978, in Chicago. The combined attendance exceeded 450 participants.

Completion of these two seminars brings to an end three years' work, and ten seminars, by the Technology Transfer Environmental Control Systems Staff and the seminar speakers. The series, which began in April 1977, has been continually updated to include the latest information on design data and research results for treatment and disposal processes. Over 3,000 consulting engineers, municipal design engineers and government pollution control officials participated in the series. A municipal seminar publication has been developed and is available through ERIC. To order copies of this two-volume publication (#4012), use the attached order form.

New Environmental Pollution Control Manual for Textile Processing Industry

A new pollution control manual for the textile industry is available from the Environmental Research Information Center (ERIC). This manual will assist process design engineers, consultants and engineering companies active in the design or upgrading of textile waste treatment facilities. Although the manual includes chapters discussing air emissions, the major emphasis is on the wastewater effluent problem. The manual is a detailed design guide discussing control alternatives and design, survey techniques and monitoring systems. Agency regulations and policy are not covered.

Lockwood Greene Engineers, Inc., of Atlanta, prepared this manual under contract to ERIC. Coordination and technical review was carried out by the Environmental Sciences Technology Committee of the American Association of Textile Chemists and Colorists. The manual (#7002) can be ordered by filling out the request form at the back of this newsletter.



REQUEST FOR TECHNOLOGY TRANSFER MATERIAL

The publications listed on this form are the only ones available through the Office of Technology Transfer.

Notice — *If you placed an order for Technology Transfer materials and have not received the material by March 30, 1979,* please resubmit your request on this form. In the future, you can expect to receive Technology Transfer material within four to six weeks of the date of request. **(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 ☐
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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 ☐

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Sludge Treatment and Disposal (2 Vols.) ..... 4012 ☐

BROCHURES

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Irrigated Agriculture and Water Quality Management ..... 5014 ☐
Forest Chemicals and Water Quality ..... 5015 ☐

HANDBOOKS

Monitoring Industrial Wastewater (1973) ..... 6002 ☐
Industrial Guide for Air Pollution Control (June 1978) ..... 6004 ☐

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● Textile Processing Industry (Oct. 1978)) ..... 7002 ☐

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Where to Get Further Information

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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.)
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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)
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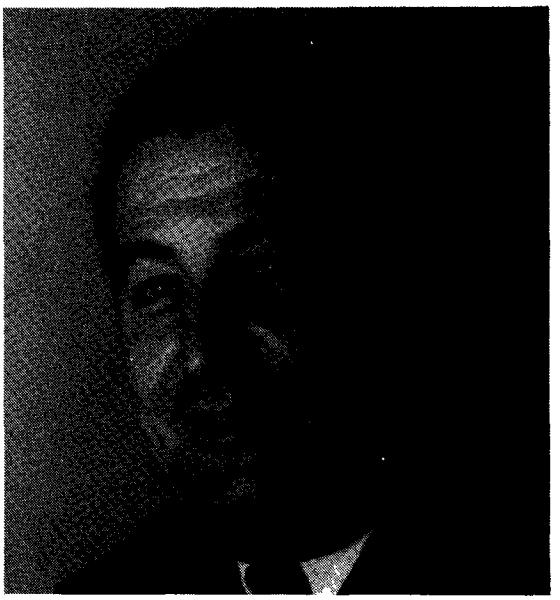
October 1978

EPA TECHNOLOGY TRANSFER

The Bridge Between Research and Use

Design Manual for Municipal Sludge Landfills Featured at 1978 WPCF Conference



Paul DeFalco, Jr., Regional Administrator for EPA, Region 9.

The newest Technology Transfer Design Manual — Municipal Sludge Landfills — will be made available for the first time at the 51st Annual Conference and Exhibition of the Water Pollution Control Federation in Anaheim, California, October 1 through 6, 1978. This year's Technical Conference promises to be the largest ever, coming on the heels of last year's successful 50th Anniversary Conference. About 10,000 persons representing all phases of the Water Pollution Control Field will be attending the 42 technical program sessions and three pre-conference workshops, while over 300 manufacturing firms and support organizations will participate in the exhibition. Paul DeFalco, Jr., Regional Administrator for EPA, Region 9, will take part in the official opening session of the convention on Monday, October 2nd. The Regional Technology Transfer Chairman for Region 9 is Fred Hoffman.

As in last year's WPCF Convention, several EPA programs will participate in one major EPA exhibit (Booth No. 127). Those programs involved are; (1) Environmental Research Information Center, (2) Effluent Guidelines, (3) Solid Waste, (4) Construction Grants, (5) Manpower and Training, (6) 208 Planning, and (7) Operations and Maintenance. Each program will have key individuals available at the exhibit to personally answer questions, discuss EPA policy, etc. We invite you to visit the EPA Booth to obtain your copy of the Municipal Sludge Landfills Design Manual and meet ERIC personnel.

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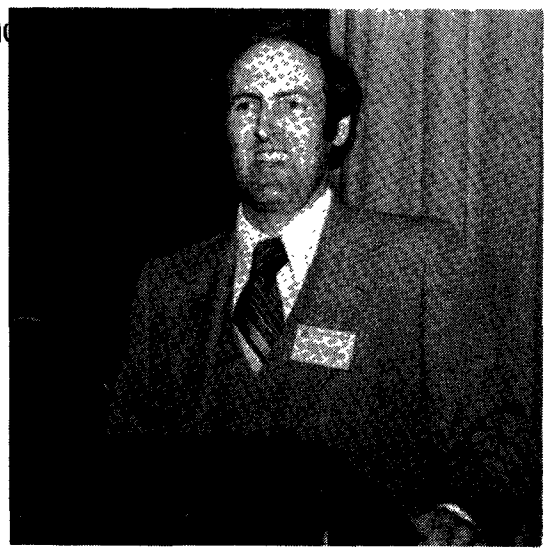
Those unable to attend the WPCF Conference can obtain the Municipal Sludge Landfills Manual by checking the appropriate box (#1010) on the order form in the back of this Newsletter.

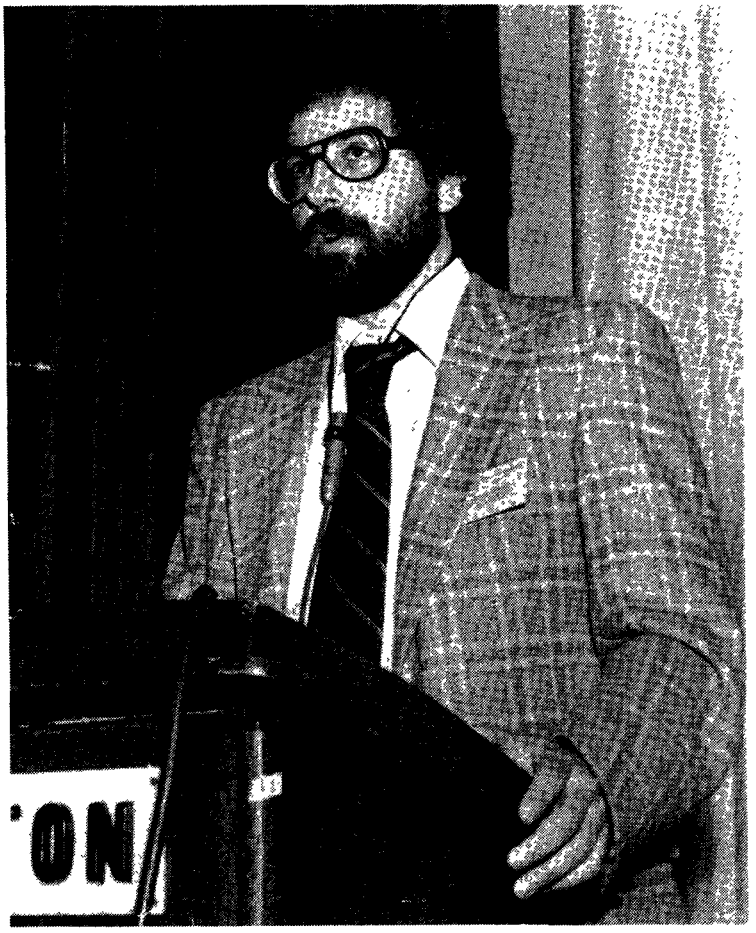


Jon C. Dyer (left), Environmental Technology Consultants, addresses the Municipal Attendees at a recent Pretreatment Seminar on local pretreatment program requirements. The story on the Pretreatment Seminars is inside the front cover.

Technology Transfer Continues Joint Municipal and Industrial Seminar Series on Pretreatment of Industrial Wastes

Five seminars on pretreatment of industrial wastes have been conducted since the last Technology Transfer Newsletter. Attendance has been good at each seminar, falling within a range from 375 to 425 attendees. These seminars were held in Atlanta, Georgia, June 27-28, 1978; Dallas, Texas, July 12-13, 1978; New York, New York, August 8-9, 1978; Chicago, Illinois, August 30-31, 1978; and Kansas City, Missouri, September 13-14, 1978.

Since implementation of the pretreatment regulations requires close cooperation between industry and municipalities, representatives from both groups comprise the audience. The seminars contain two joint sessions to allow interaction between the two parties as well as a split session specifically formulated to present information unique to the industrial or municipal representative. The seminars also offer the attendees the most up-to-date handout materials to supplement the seminar presentations. Some of the topics included in the presentation are:



Stephen Heare, EPA Office of Analysis and Evaluation, speaking on U.S. EPA Pretreatment Strategy.

- Effluent Guidelines and the Pretreatment Requirements
- Construction Grant Requirements
- Industrial Waste Surveys
- Variances
- Monitoring and Reporting Requirements
- Sources of Financial Assistance
- Sludge Disposal Alternatives

Four additional seminars on pretreatment of industrial wastes are scheduled for Regions 1, 8, 9, and 10. Please consult the Environmental Research Information Center's seminar schedule at the back of this Newsletter for specific times and locations.

If you are interested in attending any of these seminars, contact Dr. Jim Smith of this office or your appropriate Regional Technology Transfer Chairman, also listed at the back of this Newsletter.

Albert Montague, EPA Region 3, Technology Transfer Committee Chairman, addresses the audience at the Philadelph Pretreatment Seminar.

Seminars on Combined Sewer Overflow Assessment and Control Procedures

Technology Transfer has recently completed three seminars on Combined Sewer Overflow Assessment and Control Procedures. An additional two seminars are being planned for Philadelphia, Pennsylvania, on November 1-2, 1978 and Kansas City, Missouri, on November 7-8, 1978.

The first seminars were held in Hartford, Connecticut, May 18-19; Seattle, Washington, June 28-29; and Chicago, Illinois, July 25-26, 1978. Attendance at the three seminars was approximately 670 people. They were designed to present EPA policy for funding combined sewer overflow (CSO) projects and the techniques and treatment systems that are available for assessment and control of CSO discharges. Simplified techniques that can easily be used by the engineering profession were emphasized. Subject areas included.

1. Evaluating costs and benefits of CSO control
2. Analyzing the existing collection system
3. Estimating the quantity and quality of CSO
4. CSO treatment methods and sludges generated as a result of CSO control
5. Case studies on CSO assessment

For more information concerning these seminars contact your Regional Technology Transfer Chairman listed in the back of this Newsletter.

Myron Tiemens, EPA Office of Water Program Operations, Washington DC, presenting EPA funding policy at the Hartford Seminar on Combined Sewer Overflow Assessment and Control Procedures.

Roy Ellerman, EPA Region 10, Water Division addressing the audience at the Seattle Seminar on Combined Sewer Overflow Assessment and Control Procedures.

Hartford Seminar on CSO Assessment and Control Procedures.

Air Pollution Seminars Scheduled for Early 1979

Two of the most important concerns in the air pollution field are: (1) operation and maintenance of control systems and (2) control alternatives for hydrocarbon emissions. ERIC is presently planning seminars to cover each of these topics next spring.

The Operation and Maintenance Seminars are tentatively planned for Atlanta, San Francisco, and Washington, DC. Experts from manufacturing companies and industry will discuss O & M procedures for baghouses, electrostatic precipitators, and scrubbers.

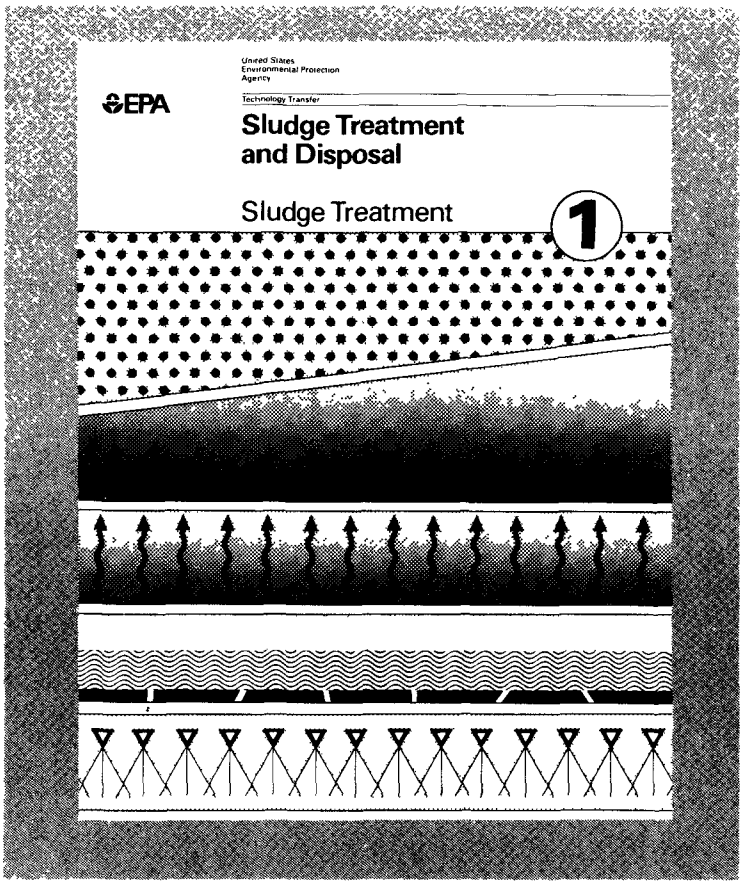
Hydrocarbon emissions can be categorized by industry as follows: surface treatment, gasoline handling, and manufacturing operations. This seminar series will concentrate on the surface treatment companies, such as metallic degreasing and coating operations, and nonmetallic processes emitting hydrocarbons. The latter is represented by paper coating, textile, and graphic arts processes. Prospective conference sites are Chicago, Philadelphia, and Los Angeles.

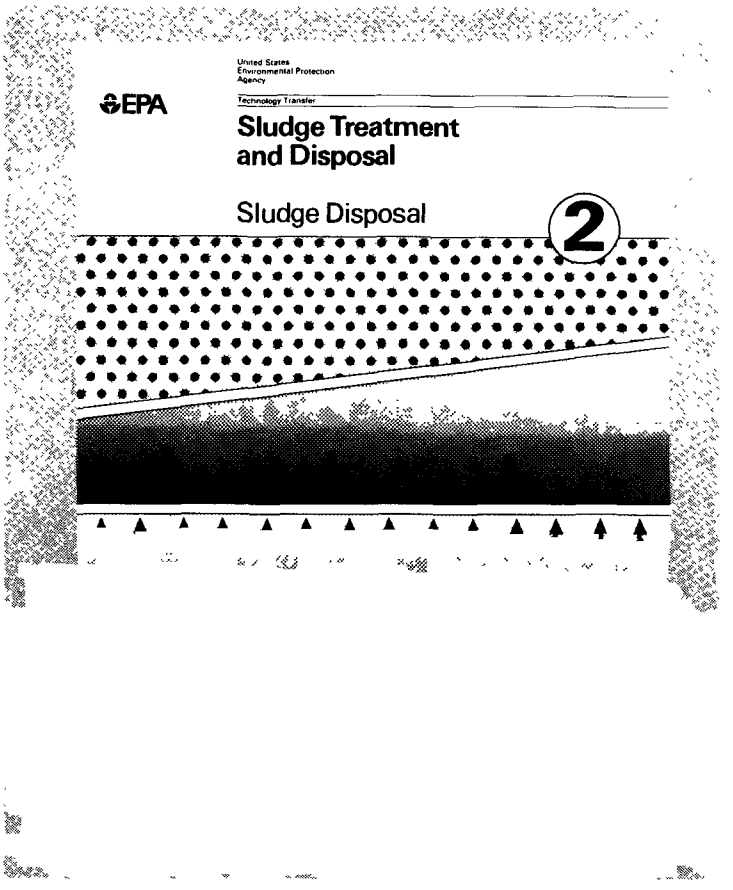
New Seminar Publication: "Sludge Treatment and Disposal"

A new publication has been developed for the Technology Transfer Seminar Series on Design of Sludge Treatment and Disposal Systems. It is printed and is now available for distribution. This two-volume document includes sections on the stabilization of sludge by lime addition, anaerobic digestion and aerobic digestion, the thermal conditioning of sludge, and the thickening and dewatering of sludges. Other sections discuss the incineration and starved-air combustion of sludge, composting, land utilization, and the landfilling of sludges. Design criteria, performance data and design examples are included for each process discussed.

Principal contributors to this document included Drs. J.B. Farrell and J.A. Ryan, U.S. EPA-MERL, Cincinnati, Ohio; R.F. Noland and J.D. Edwards of Burgess and Niple, Columbus, Ohio; N.A. Mignone of Envirex, Waukesha, Wisconsin; Dr. G.M. Wesner of Culp/Wesner/Culp in Santa Ana, California, J.R. Harrison, Consulting Engineer from Hockessin, Delaware; R.B. Sieger from Brown and Caldwell in Walnut Creek, California; Dr. L.E. Sommers, Purdue University, West Lafayette, Indiana; C.E. Pound, Metcalf and Eddy Engineers, Palo Alto, California; Dr. R.J. Lofty of SCS Engineers in Long Beach, California; and J.J. Walsh of SCS Engineers, Reston, Virginia.

This publication can be obtained by checking the appropriate box (#4012) on the order form in the back of this Newsletter.





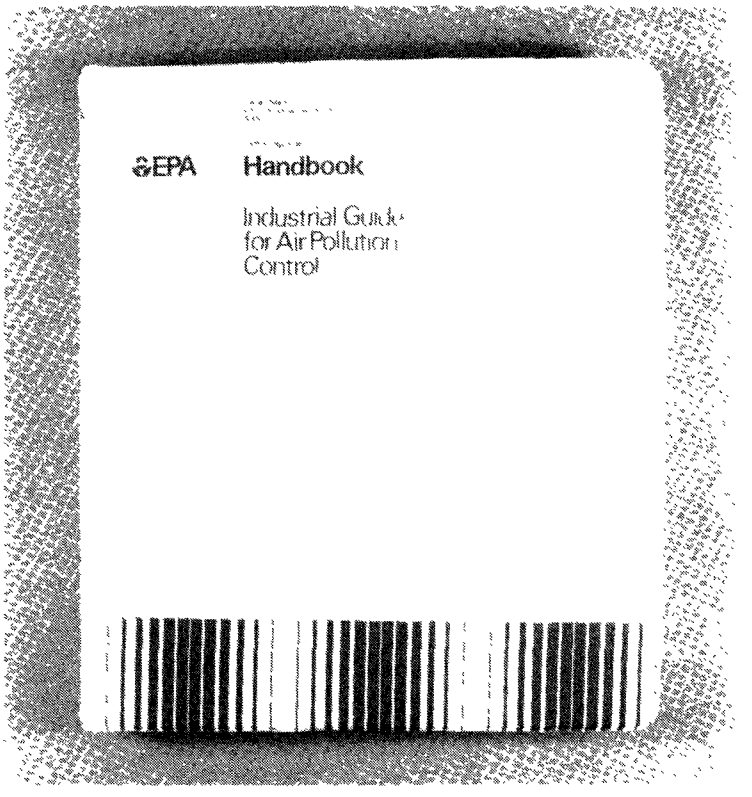
ERIC Publishes Industrial Guide for Air Pollution Control

This handbook is intended for plant managers, engineers, and other industrial personnel responsible for plant compliance with air pollution regulations. It is to serve as a set guidelines and is oriented to those small and intermediate sized companies that do not have an environmental ontrol staff. Achieving and maintaining compliance with r pollution regulations requires expertise that is beyond e usual range of skills and experience of industrial plant ersonnel. The handbook, therefore, presents criteria for valuation of outside firms or consultants who offer ecialized environmental services.

he handbook was introduced at the Air Pollution Control ssociation Exhibition in Houston, Texas, June 28-30, 978. Over 2000 copies of the handbook were distributed the meeting.

he Air Pollution Control Handbook emphasizes three ajor phases: achieving compliance, demonstrating comiance, and maintaining compliance. Specific subjects clude techniques for conducting a plant emission survey, summary of air pollution regulations, concepts of nission testing and monitoring, and a guide to maintaing compliance status.

his handbook is (# 6004) on the order form at the back this Newsletter.



Capsule Report: Recovery of Spent Sulfuric Acid from Steel Pickling Operations

Approximately 100 million tons of steel are produced very year in the United States. During manufacturing, oring, and shipping, the steel develops a surface coating oxidized iron which must be removed before the steel an be processed further. The scale can be removed by a ckling process, where the steel is immersed in an acid ath which dissolves the scale and some of the iron. The eation of spent pickle liquor creates a pollution problem r the manufacturer. Treatment alternatives include covery of the acid, neutralization of the spent acid prior discharging, or contract disposal. This Capsule Report ovides small manufacturers using sulfuric acid pickling ith the technical and economic information necessary to lect the treatment technologies best suited for their cilities. If you want a copy, check box (#2017) on the der form.

National Conference on Water Conservation and Municipal Wastewater Flow Reduction

The U.S. Environmental Protection Agency is sponsoring a conference on November 28-29, 1978, at Ramada-The O'Hare Inn (Chicago O'Hare Airport) entitled: National Conference on Water Conservation and Municipal Wastewater Flow Reduction.

Conference attendance is limited to 500 people, and no registration fee is required. Technical areas covered during the two day meeting will include:

- Water & Wastewater Management Issues
- Regulations Affecting Water Supply, Wastewater and their Treatment
- Water and Wastewater Conservation Technology
- Public Participation/Education in Water Conservation
- Case Studies of Water Conservation and Waste Flow Reduction Projects

National leaders will speak on Water Conservation policy at the Federal and State levels, and scientists and water resource managers will present current technology in water conservation and its economic and social impact. Case studies will be presented to illustrate water conservation programs.

This conference is one form of Agency response to help implement the President's national water policy, in which a cornerstone element is attention to conservation of water. Growing Congressional interest in the topic is shared with heightened attention on the parts of many States, regions and local areas facing problems of water quantity, or water quality, or excessive hydraulic loads on wastewater treatment systems, under circumstances of rapidly rising construction and operational costs for potable water systems and for wastewater treatment processes alike.

Persons interested in attending or wanting additional information should write:

U.S. Environmental Protection Agency
ERIC
Cincinnati OH 45268

Attn: Greg Brown
513/684-7394

New Process Design Manual: Municipal Sludge Landfills

The Process Design Manual for Municipal Sludge Landfills is the result of a joint effort between the EPA Office of Solid Waste and ERIC. Prime contractor for the manual was SCS Engineers of Reston, Virginia. This manual provides guidance for the planning, design and operation of a landfill receiving municipal wastewater treatment plant sludge. Major alternative sludge landfilling methods are identified and described. Guidance is given on the selection of the landfilling method which is best suited for a given combination of sludge characteristics and site conditions. For each landfilling method, the following features are addressed: public participation program, site selection, design, operation, monitoring, completed site, management, and costs. Design examples and case studies are given a strong emphasis.

The manual is available upon request from ERIC. To order, check box (#1010) on the order form at the back of the Newsletter.

Workshops on Use of Nonpoint Source Pollution Assessment Models

Workshops will be presented on the use of models for environmental planning in the areas of agricultural and generalized nonpoint source runoff, and on screening methodology for state-wide or large basins.

The Workshop on use of Agricultural Runoff (ARM) and Nonpoint Source (NPS) Models for Planning and Best Management Practice Analysis will be held in Atlanta, Georgia, on October 23-27, 1978. It is intended for individuals who perform modeling to determine water quality for rural drainage basins. Enrollment at the five day workshop will be limited to accommodate the actual computer terminal) applications approach planned. The workshop will include:

. Model organization and operation

2. Parameter estimation

3. Calibration process and testing/verification

. Application using real watershed data

The Workshop on State-wide Screening Methodology, to be held in New Orleans, Louisiana, October 30 through November 3, 1978, is intended for engineers and planners who are involved in evaluating surface water quality in Section 208 nondesignated areas. The manual, "Water Quality Assessment: A Screening Method for Nondesignated 208 Areas" (EPA-600/9-77-023) will be utilized throughout the workshop. The five day workshop will be divided into lecture and problem solving periods and will cover; (1) analytical methods for assessment of rivers, impoundments, and estuaries, and (2) evaluation of point and nonpoint sources of pollution. The analyses are designed to be performed with the assistance of a desk top calculator and a minimal amount of data input.

These two workshops will be offered again in the Spring of 1979 with probable locations in the midwest and northeast. For more information concerning these workshops contact:

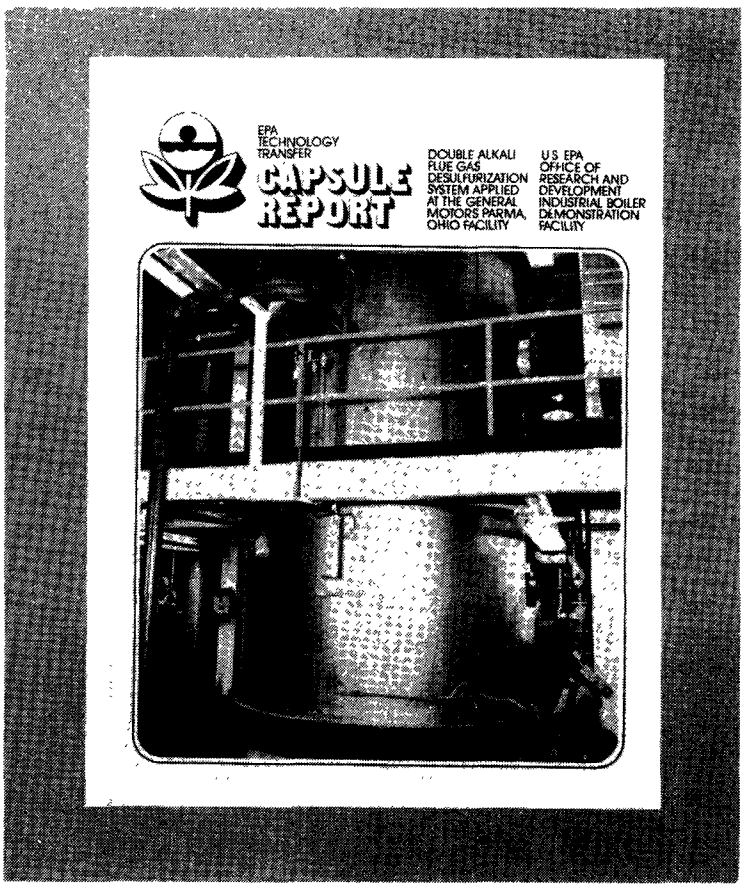
U.S. Environmental Protection Agency
ERIC
Cincinnati OH 45268

Attn: Orville Macomber
Phone 513/684-7394

Double Alkali Flue Gas Desulfurization Capsule Report Available

In 1974, General Motors and the EPA Industrial Environmental Research Laboratory in Research Triangle Park, North Carolina, began a cooperative program to evaluate the sulfur dioxide removal system at the GM Chevrolet Plant in Parma, Ohio. The test program is summarized in a new ERIC Capsule Report.

The double alkali process is a nonregenerable system capable of high SO_2 removal efficiencies and excellent dewatering properties of the alkali waste. The GM Parma facility has demonstrated a consistent 90 percent SO_2 removal capability. The construction cost was 3.2 million dollars in 1975. Scrubbers are installed on each of the existing four boilers with a total generating capacity of 20,000 pounds of steam per hour. This report is (#2016) on the order form.



Design Seminars for Small Wastewater Treatment Systems

Two additional seminars for the design of wastewater treatment systems for individual homes and small communities have been held since March. These seminars were held in East Brunswick, New Jersey, June 21-22, 1978, and Minneapolis, Minnesota, September 6-7, 1978.

Fifteen of these seminars, with a total attendance of approximately 4,000 have been given since March 1977. If you have been unable to attend any of these seminars, a 3-volume seminar publication is available upon request. Check box (#4011) on the order form to obtain your copy.

Technology Transfer Holds an Additional Municipal Design Seminar on Sludge Treatment and Disposal

Technology Transfer has recently completed its fourth seminar on Sludge Treatment and Disposal for 1978.

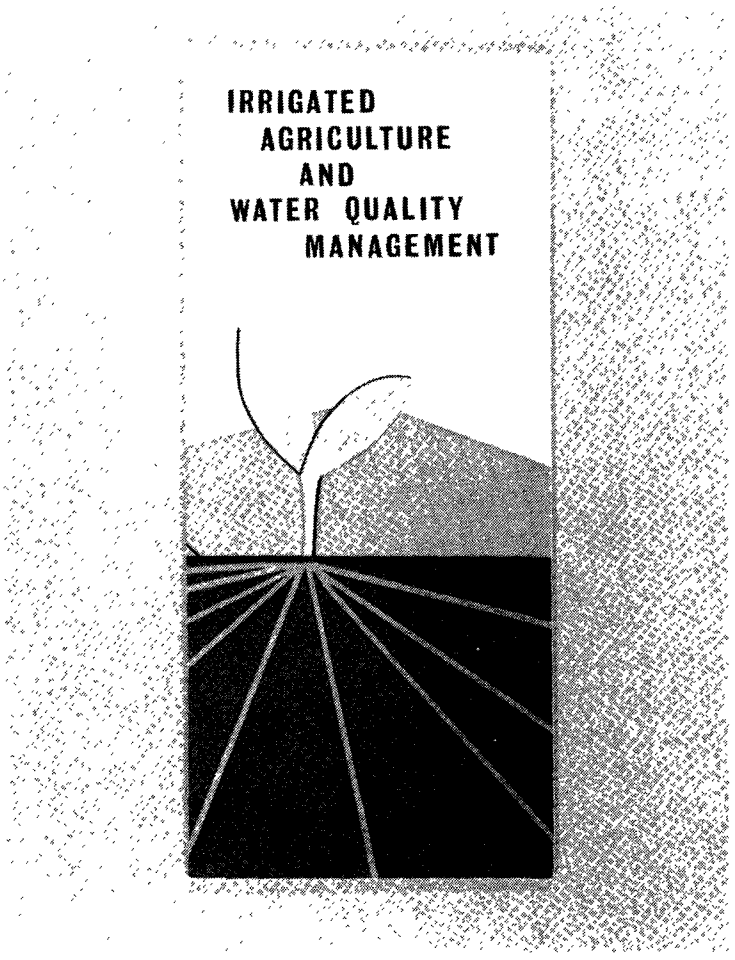
The first seminar was held in Philadelphia, Pennsylvania, March 30-31, 1978; the second in Portland, Oregon, May 3-4, 1978, and the third in Los Angeles, California, May 10-12, 1978. Each seminar had approximately 200 or more attendees and featured in-depth design examples and up-to-date handout material to supplement the seminar presentations. The Los Angeles seminar included a field trip to the Los Angeles County Sanitation District's Joint Plant Solids Processing Facility and Pilot Study.

The last seminar was held in Kansas City, Missouri, June 14-15, 1978. The 200 attendees at the Sheraton-Royal Hotel heard the latest design information on new technologies such as dewatering by continuous belt filter presses or combusting in a co-pyrolysis (starved air combustion) system.

New Technology Transfer Publication Available

A brochure entitled "Irrigated Agriculture and Water Quality Management" is now available from Technology Transfer. Through the use of photographs and graphic displays, the brochure outlines pollution problems that result from irrigation and discusses surface run-off and subsurface flows, and presents solutions that are available for controlling pollution from these sources. Also discussed are methods of farm water management that can be used to reduce irrigation water use and the problems of their implementation such as: legal problems of water rights, economic costs of controls and the social goals such as institutional measures that need to be accommodated.

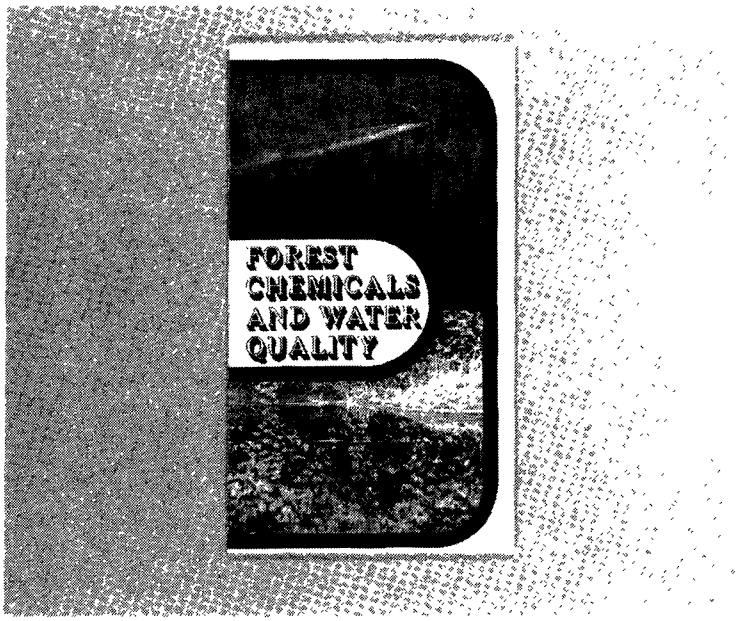
You may obtain this brochure by checking the appropriate box (#5014) on the order form located at the back of the Newsletter.



"Forest Chemicals and Water Quality" Brochure Available

A brochure entitled "Forest Chemicals and Water Quality" prepared by EPA Region 10 is now available from Technology Transfer. Best management practices that protect the environment and increase the yield of our forests are presented in this document. Topics discussed in this brochure are applications of chemicals by both aerial and ground methods, environmental concerns over toxic and nutrient enriching chemicals, natural influences such as rainfall and soil characteristics, on applications of chemicals, factors affecting the degree of a chemical impact, and chemical, environmental, operational, technical and managerial considerations affecting the application of chemicals to our forests.

You may obtain this publication by checking the appropriate box (#5015) on the order form at the back of the Newsletter.



Environmental Research Information Center 1978 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
Pretreatment	November 1-2, 1978	8 Denver
Pretreatment	November 14-15, 1978	1 Boston
Pretreatment	December 5-6, 1978	10 Seattle
Pretreatment	December, 1978	9 San Francisco
Combined Sewer Overflows	November 1-2, 1978	3 Philadelphia
Combined Sewer Overflows	November 7-8, 1978	7 Kansas City

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 312 353-2200 (Mich., Wis., Minn., Ill., Ind., Ohio)
6	Mildred Smith	Environmental Protection Agency 1201 Elm Street First International Building Dallas, Texas 75270 214 767-2697 (Texas, Okla., Ark., La., N. Mex.)
7	John Coakley	Environmental Protection Agency 1735 Baltimore Avenue Kansas City, Missouri 64108 816 374-5971 (Kansas, Nebr., Iowa, Mo.)
8	Elmer Chenault	Environmental Protection Agency 1860 Lincoln Street Denver, Colorado 80203 303 837-2277 (Colo., Mont., Wyo., Utah, N.D., S.D.)
9	Fred Hoffman	Environmental Protection Agency 215 Fremont Street San Francisco, Calif. 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)

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uspended Solids Removal (Jan. 1975) . . . . . .1003 ☐
pgrading Existing Wastewater Treatment Plants (Oct. 1974) . . .1004 ☐
ulfide Control in Sanitary Sewerage Systems (Oct. 1974) . . . . .1005 ☐
ludge Treatment and Disposal (Oct. 1974) . . . . . .1006 ☐
itrogen Control (Oct. 1975) . . . . . .1007 ☐
and Treatment of Municipal Wastewater (Oct. 1977) . . . . . .1008 ☐
'astewater Treatment Facilities for Sewered Small Communities (Oct. 1977) . . . . . .1009 ☐
unicipal Sludge Landfills (Oct. 1978) . . . . . .1010 ☐

'ECHNICAL CAPSULE REPORTS

ecycling Zinc in Viscose Rayon Plants by Two Stage Precipitation .2001 ☐
olor Removal from Kraft Pulping Effluent by Lime Addition . . .2002 ☐
ollution Abatement in a Copper Wire Mill . . . . . .2003 ☐
irst Progress Report: Limestone Wet-Scrubbing Test Results at the EPA Alkali Scrubbing Test Facility . . . . . .2004 ☐
ry Caustic Peeling of Clingstone Peaches . . . . . .2005 ☐
ollution Abatement in a Brewing Facility . . . . . .2006 ☐
lue Gas Desulfurization and Sulfuric Acid Production Via Magnesia Scrubbing . . . . . .2007 ☐
econd Progress Report: Lime/Limestone Wet-Scrubbing Test Results at the EPA Alkali Scrubbing Test Facility . . . . . .2008 ☐
agnesium Carbonate Process for Water Treatment . . . . . .2009 ☐
hird Progress Report: Lime/Limestone Wet-Scrubbing Test Results at the EPA Alkali Scrubbing Test Facility . . . . . .2010 ☐
irst Progress Report: Wellman-Lord SO_2 Recovery Process – Flue Gas Desulfurization Plant . . . . . .2011 ☐
Virl Device for Regulating and Treating Combined Sewer Overflows . . . . . .2012 ☐
abric Filter Particulate Control on Coal-Fired Utility Boilers: Nucla, CO. and Sunbury, PA . . . . . .2013 ☐
rst Progress Report: Static Pile Composting of Wastewater Sludge . . . . . .2014 ☐
ficient Treatment of Small Municipal Flows at Dawson, Minn. . . . . .2015 ☐
ouble Alkali Flue Gas Desulfurization System Applied at the General Motors Parma, Ohio Facility . . . . . .2016 ☐
ecovery of Spent Sulfuric Acid from Steel Pickling Operations. .2017 ☐

NDUSTRIAL SEMINAR PUBLICATIONS

ograding Poultry Processing Facilities to Reduce Pollution (3 Vols.) . . . . . .3001 ☐
ograding Metal Finishing Facilities to Reduce Pollution (2 Vols.) . . . . . .3002 ☐
ograding Meat Packing Facilities to Reduce Pollution (3 Vols.) . . . . . .3003 ☐
ograding 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 ☐
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Nitrification and Denitrification Facilities . . . . . .4004 ☐
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Alternatives for Small Wastewater Treatment Systems. . . . . .4011 ☐
• Sludge Treatment and Disposal (2 Vols.). . . . . .4012 ☐

BROCHURES

Logging Roads and Water Quality. . . . . .5011 ☐
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 ☐

HANDBOOKS

Analytical Quality Control in Water and Wastewater Laboratories (1972) . . . . . .6001 ☐
Monitoring Industrial Wastewater (1973) . . . . . .6002 ☐
Methods for Chemical Analysis of Water and Wastes (1974). . . .6003 ☐
• Industrial Guide for Air Pollution Control (June 1978) . . . . . .6004 ☐

INDUSTRIAL ENVIRONMENTAL POLLUTION CONTROL MANUALS

Pulp and Paper Industry – Part 1/Air (Oct. 1976) . . . . . .7001 ☐

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 still 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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June 1978

EPA

TECHNOLOGY TRANSFER

The Bridge Between Research and Use

Pretreatment Seminars Underway

The first in a series of Technology Transfer Seminars on pretreatment requirements for for industries discharging to municipal treatment systems was held in Philadelphia, May 24-25, 1978. These seminars are designed to provide attendees the latest regulatory information relating to pretreatment and the major items to be considered in establishing a pretreatment program.

Since implementation of the pretreatment regulations requires very close cooperation between industry and municipalities, representatives from both comprise the audience. The seminar contains two joint sessions to allow interaction between the two parties as well as separate sessions specifically formulated to present information only for the industrial or municipal representative. Some of the topics presented at the seminar are:

1. Industrial waste surveys
2. User changes
3. Variances
4. Monitoring and reporting requirements
5. Sources of financial assistance
6. Sludge disposal alternatives

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Attendance is limited to 300 at each seminar to encourage attendee participation. Scheduling of future pretreatment seminars is indicated at the back of this newsletter.

Design Seminar for Small Wastewater Treatment Systems

Three seminars for the design of wastewater treatment systems for small communities have been held since January. These seminars were held in Columbus, Ohio, January 10-11, 1978; San Juan, Puerto Rico, February 1-3, 1978; and Boise, Idaho, March 14-15, 1978.

The San Juan Seminar also included sessions on Sludge Treatment and Disposal to accommodate special needs in the area. These sessions were presented by Ronald Sieger, Brown & Caldwell Engineers; Jack Harrison, Wilmington, Delaware; Nicholas Mignone, Envirex; and Eliot Epstein, U Department of Agriculture.

Two additional seminars for small wastewater treatment systems are scheduled They are:

June 21-22 — East Brunswick, New Jersey

Sept. 6-7 — Minneapolis, Minnesota

If you are interested in attending either one of these semi nars, please contact either Clifford Risley or Robert Olson the address and phone number listed towards the back of this newsletter.

Technology Transfer Workshop Planned

A workshop on the use of models for Environmental Planning in the areas of agricultural run-off, generalized non-point source, and screening methodology for statewide or large basins.

Two separate 5-day intensive training courses are being planned for the late summer or early fall of 1978. They are for engineers and other technical personnel from both the public and private sectors engaged in "hands-on" analysis of non-point source pollution problems and 208 planning.

Use of the EPA Agricultural Run-off Management (ARM) and Non-point Source (NPS) models. Enrollment will be limited to accommodate the actual computer (terminal) applications approach planned. Probable location for the first worksho in this subject area will either be Atlanta or Chicago.

Use of simplified water quality screening methodology for large basin planning. The technique to be utilized will be based upon the EPA Manual "Water Quality Assessment: Screening Method for Nondesignated 208 Areas". Non-computer calculational techniques, including those for no point sources, rivers, lakes and estuaries will be highlight

Attendance will be limited at these workshops, therefore, early expressions of interest and requests for additional d tails are encouraged. Contact Orville Macomber of the ER staff in Cincinnati at (513) 684-7394

Asphalt and Forest Products Seminar Series Completed

Two series of industrial seminars have been completed recently. The fourth and final asphalt industry seminar, sponsored by EPA, the National Asphalt Pavement Association and the Air Pollution Control Association was held in Cincinnati on March 1 and 2, 1978. Approximately two hundred engineers, asphalt owners and operators ranging from Canada to Puerto Rico were in attendance. The seminar contained a combination of regulatory and technical information on air, water, solid waste, and noise subjects. Process and control system technology were discussed for conventional, drum mix, and recycle plants.

The second forest products seminar in Portland, Oregon, on April 4-6, 1978, attracted nearly 400 participants from industry, control agencies, and consulting firms. Among the subjects discussed were non-point source programs, air pollution regulations and control technology, and water quality standards with specific examples of source control.

Seminar publications are being developed for the two industries. They will be available before the end of the year.

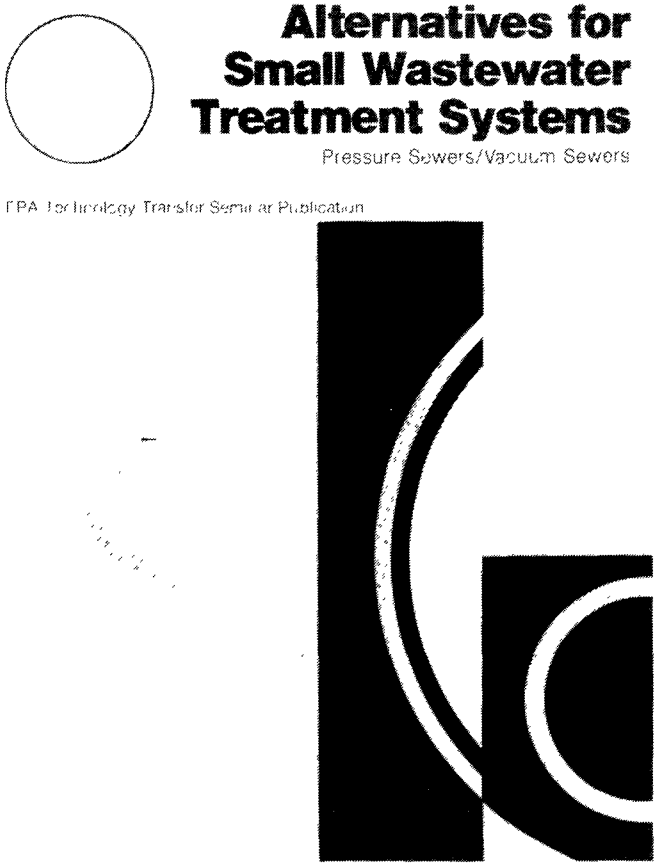
Cincinnati Asphalt Conference, March 1978

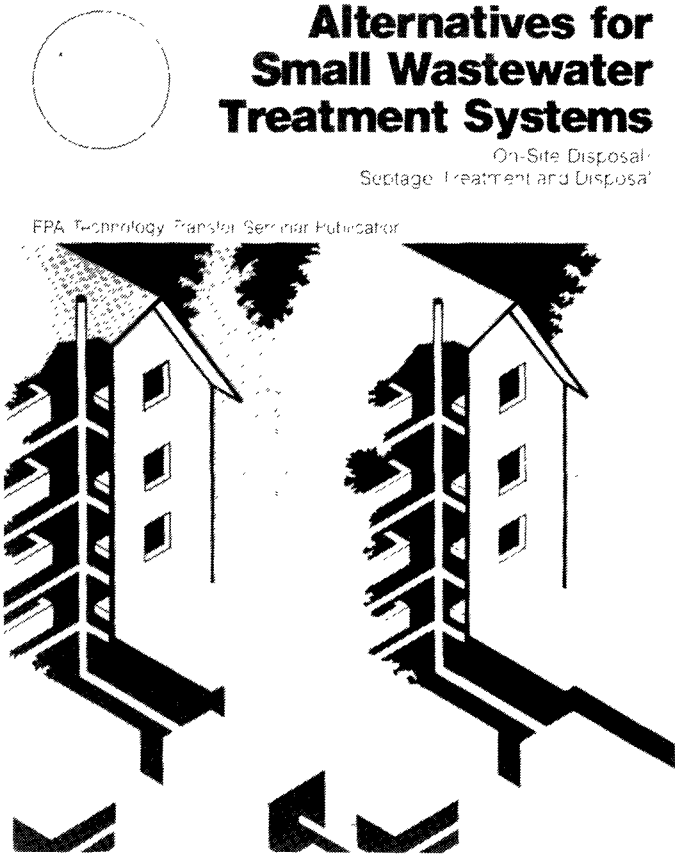
\lternatives for
;mall Wastewater
'reatment Systems

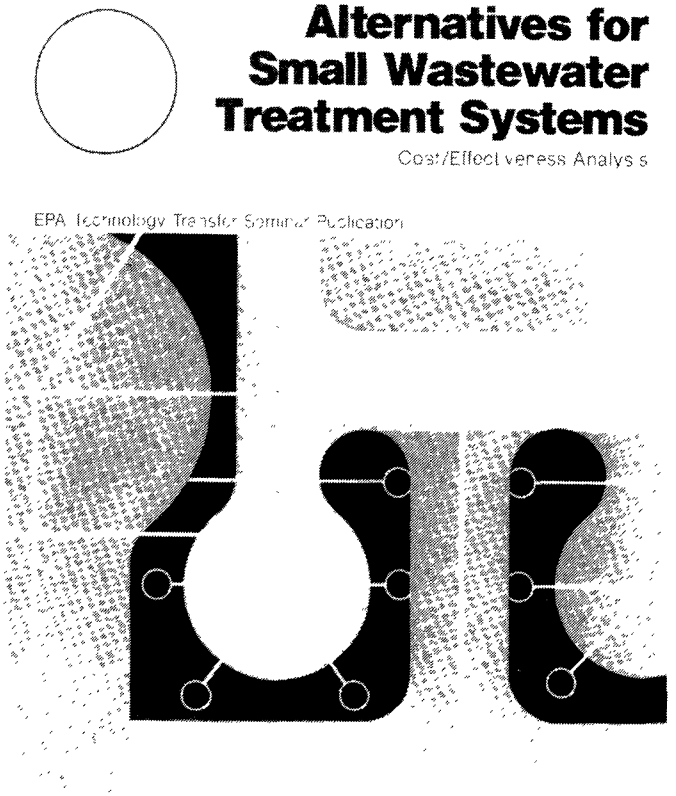
, new publication developed for the Technology Transfer
eminar Series for Design of Small Wastewater Treatment
ystems is now available. This 3-volume document in-
udes sections on Pressure Sewers, Vacuum Sewers, On-
ite Disposal, Septage Treatment and Disposal, and Cost/
ffectiveness Analysis. Design information, cost data, and
ase-histories are included for each of these subjects

uthors of this document are James F. Kreissl, U.S. EPA-
1ERL, Cincinnati, Ohio; Joseph Rezek and Ivan Cooper of
ezek, Henry, Meisenheimier & Gende, Libertyville, Illinois;
/illiam Boyle, Richard Otis, James Converse, and Jerry
yler of the University of Wisconsin at Madison; and Jerrold
royan, Brown & Caldwell, Eugene, Oregon.

ou may obtain this publication by checking the appropriate
ox (#4011) on the order form in the back of the newsletter.







New Technology Transfer Publication Available

A full color brochure entitled "Irrigated Agriculture and Water Quality Management" is now available from Technology Transfer. Through the use of photographs and graphic displays, the brochure outlines pollution problems that result from irrigation and discusses surface run-off and subsurface flows, and presents solutions that are available for controlling pollution from these sources. Also discussed are methods farm water management that can be used to reduce irriga tion water use and the problems of their implementation such as: legal problems of water rights, economic costs of controls and the social goals such as institutional measure that need to be accommodated.

You may obtain this brochure by checking the appropriate box (#5014) on the order form located on the back of the newsletter.

First Capsule Reports in Municipal Area Published

The first three Technology Transfer Capsule Reports dealing with municipal pollution control technology have been printed and are now available. They are:

SWIRL Device for Regulating and Treating Combined Sewer Overflows (#2012) — This Capsule Report describes the results of a full-scale prototype SWIRL unit that controlled real overflows in Syracuse, N.Y., and discusses other areas of application.

First Progress Report on Static Pile Composting of Wastewater Sludge (#2014) — Static pile composting and its application in the municipalities of Bangor, Maine, and Durham, New Hampshire are described.

Efficient Treatment of Small Municipal Flows at Dawson, Minnesota (#2015) — The Dawson project demonstrated that small plants can provide consistent nitrification and highly reliable and efficient removal of BOD and SS.

You may obtain these publication by checking the appropriate boxes on the order form on the back of this newsletter.

Great Lakes Operation and Maintenance Workshop Held Recently

A summary of three annual EPA surveys of municipal wastewater treatment facilities indicated that 48% of the facilities meet their design objectives and the secondary treatment objective of 30 mg/l for both BOD and suspended solids concentrations. Identification of the reasons for, and potential ways to improve, this level of plant performance was the subject of a workshop in Chicago on March 15-17, 1978. The Great Lakes Workshop: Improving Operation and Maintenance of Municipal Treatment Plants was jointly sponsored by the Great Lakes National Program Office of EPA Region V, and the Review Board of the Canada/Ontario Agreement on Great Lakes Water Quality.

Sixty invitees, representing disciplines or with responsibilities essential for the proper operation of treatment facilities, attended. Constituencies represented included design engineers, equipment manufacturers, plant operators and managers, municipal decision makers, State/Provincial and Federal regulatory authorities, and public sector interests. Invited papers on relevant topics, including results of a 3½ year U.S. National O & M Cause and Effect Survey, were presented in the first session. The attendees assembled in working groups during the remaining two days, identified the most significant problems and proposed alternative solutions. Multiple problem statements were synthesized into the following major areas of deficiency.

- Public awareness and support of proper operations and maintenance.
- Adequacy of O & M budget levels.
- Number and technical capability of operators, equipment representatives and regulatory review authorities.
- Maintenance plans.
- Regulatory relating to permit requirements and equipment selection procedures.
- Design considerations related to operational and maintenance reliability.
- Accountability among the constituents with regard to long-term operability.

The O & M "problem" includes a spectrum of subissues which vary in severity and applicability among wastewater treatment facilities. A remedial program must, therefore, include some plant-specific components in addition to approaches having general applicability. This complexity was recognized and addressed in the solutions proposed by the workshop participants. Many alternative solutions were discussed with the following preferred solutions identified.

- Federally fund, on a one-time basis, operation and maintenance improvement grants. The purpose of these grants would be to independently establish a comprehensive correction program including preparation of an O & M manual, cost-accounting procedures, preventative maintenance plans, staffing recommendations, and specific training requirements emphasizing on-site training.
- Require mandatory operator certification.
- Incorporate independent review of facility designs in terms of operational and maintenance and reliability considerations.
- Incorporate in future wage negotiations incentive pay schedules for operators based on permit compliance monitoring.
- Publicize locally the cost-effectiveness of O & M expenditures in improving water quality.
- Provide greater emphasis in equipment specification and procurement processes to insure, even at higher initial capital cost, more reliable equipment.
- Redirect research emphasis from new process development to operations and maintenance considerations of existing technology.

Proceedings of the Workshop will be available through the Great Lakes National Program Office, EPA, Region V.

Technology Transfer Continues Municipal Design Seminar Series on Sludge Treatment and Disposal

Technology Transfer has recently completed its third of five planned seminars on Sludge Treatment and Disposal for 1978.

The first seminar was held in Philadelphia, PA, March 30-31, 1978, and was attended by over 300 people. This seminar was redesigned from those conducted in 1977 and featured in-depth design examples and the most up-to-date handout material to supplement the seminar presentations. The new seminar format provided for better information exchange and participation by the attendee.

The second seminar in Portland, Oregon, May 3-4, 1978, was designed for the region and addressed problems that are encountered by local consultants and municipalities.

The Los Angeles Seminar was expanded to three days and featured a field trip by participants to the Los Angeles Sanitation District Joint Plant Solids Processing Facility and Pilot Study. Also included in the seminar were presentations by local engineers to discuss regional developments in sludge treatment and disposal.

It is hoped that by tailoring these seminars to apply to a specific region, a more effective information dissemination can occur.

For more information concerning these seminars contact your Regional Technology Transfer Chairman listed in the back of this newsletter.

Capsule Report for Utility Fabric Filter Baghouses Now Available

EPA's Industrial Environmental Research Laboratory in Research Triangle Park, N.C. has funded projects to analyze the performance of two of the first coal-fired power plants located at Nucla, Colorado and Sunbury, Pennsylvania, and equipped with fabric filters.

The Nucla fabric filtration facility was designed to control the entire particulate load from the three stoker-fired boilers of the 39 Mw facility. The installation has been able to meet the Colorado air pollution regulations with ease.

The Sunbury baghouse replaced an electrostatic precipitator collection system which was unable to meet the particulate control efficiency specified in state regulations. The replacement bag system has met the Pennsylvania regulations since its initial operation in 1973.

The capsule report summarizes performance and cost data for the two facilities. This report can be obtained by checking the appropriate box (#2013) on the order form in the back of the newsletter.

National Conference on Lake Restoration Scheduled for Minneapolis

On August 22-24, in Minneapolis, a National Conference sponsored by the U.S. EPA's Office of Water Quality Standards and the Environmental Research Information Center will be held to address how local and state governments can best conduct programs for restoring lakes.

The conference is designed to enhance the effectiveness of the Federal Water Pollution Act, Section 314, which provides federal grants to municipal and state governments to restore publically-owned freshwater lakes. Representatives of municipal and state government agencies working on pollution control and recognized experts on lakes will be attending.

During the Conference, specialists from government research organizations and academic institutions will present information needed to prepare a comprehensive lake restoration plan. Speakers will discuss how to transfer experimental or theoretical knowledge into practical applications to meet Federal Water Quality Goals by 1983. Methods by which local authorities can protect lakes will be presented and successful state restoration programs conducted in Minnesota, Florida, South Dakota, and Vermont will be explored. Federal experts will present an overview of governmental grant programs for pollution control. Small wastewater treatment systems as well as point and non-point sources will be discussed with emphasis on achieving water quality standards. Methods of assessing lake restoration problems and in-lake treatments will also be examined.

As a special conference feature, experts will examine state-of-the-art restoration. Presentations will include Biological Management of Lakes and Methods of Evaluating the Effe tiveness of Restoration Techniques.

The Conference, which is being coordinated by Battelle, Columbus, will be held August 22-24, Tuesday through Thursday, at the Sheraton Ritz Hotel, Minneapolis, Minnesc Additional information may be obtained from Susan Armstrong, Battelle Laboratories, 505 King Avenue, Columbus, Ohio 43201 (telephone 614-424-7769).

"Forest Chemicals and Water Quality Brochure Available

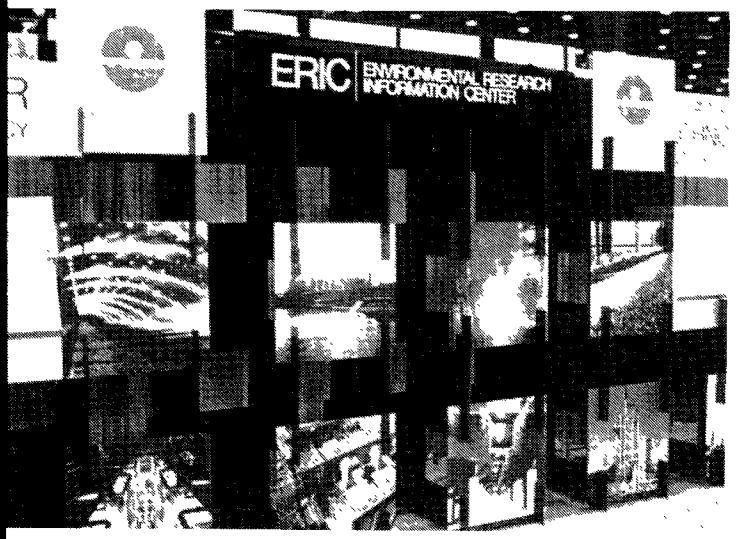
A full color brochure entitled "Forest Chemicals and Wate Quality" prepared by EPA Region X is now available from Technology Transfer. Best management practices that prot the environment and increase the yield of our forests are presented in this document. Topics discussed in this brochure are applications of chemicals by both aerial and grou methods, environmental concerns over toxic and nutrient enriching chemicals, natural influences such as rainfall an soil characteristics, on applications of chemicals, factors affecting the degree of a chemical impact, and chemical, environmental, operational, technical and managerial considerations affecting the application of chemicals to our forests.

You may obtain this publication by checking the appropriat box (#5015) on the order form on the back of the newslett

Conference on Improving Management Practices for Irrigated Agriculture

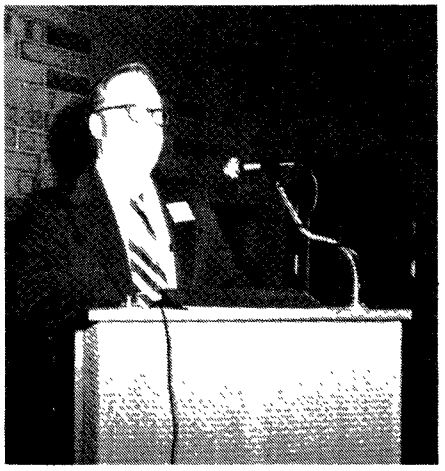
Technology Transfer, EPA Region IX and the Water Resources Center-Cooperative Extension Service of the University of California sponsored a conference held at the University of California in Davis, California on April 3 and 4, 1978.

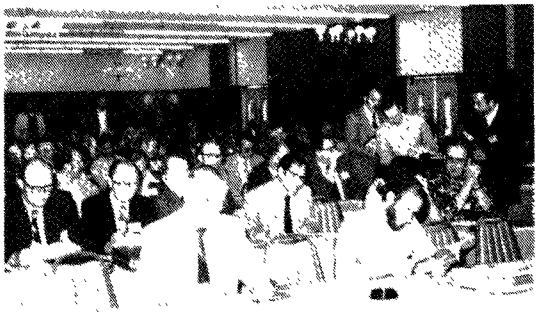
The conference presented the latest tools and concepts that have been developed through research and demonstration projects for implementing programs of improved management practices for irrigated agriculture. These programs are directed at increasing crop yields and improving water quality. In addition, presentations were made on the progress achieved in implementation of control solutions by various irrigation and water management groups. Available assistance for implementing agriculture programs related to water management was also discussed



ERIC Plans Exhibit for Annual APCA Convention in Houston

The Environmental Research Information Center will display an exhibit at the annual Air Pollution Control Association meeting and exhibition on June 27-29, 1978, at the Albert Thomas Convention Center in Houston, Texas This is the first year that ERIC has participated in the meeting. The latest Technology Transfer literature will be available, including a capsule report summarizing the EPA flue gas desulfurization test program of the double alkali process at the General Motors facility in Parma, Ohio. We invite you to visit the EPA Exhibit, Booth No. 310. Since the report is still being printed at this time, our readers will be able to obtain the capsule report through the next newsletter.





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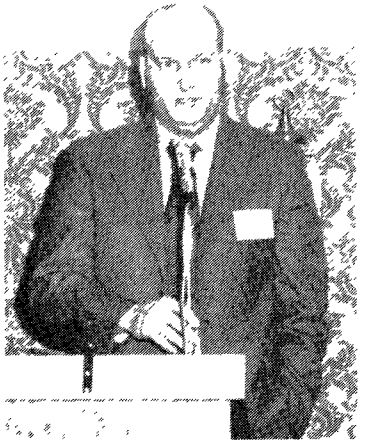

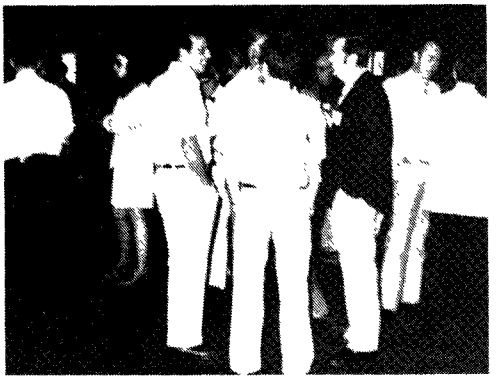

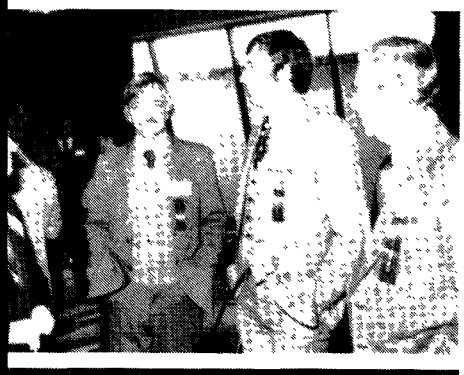

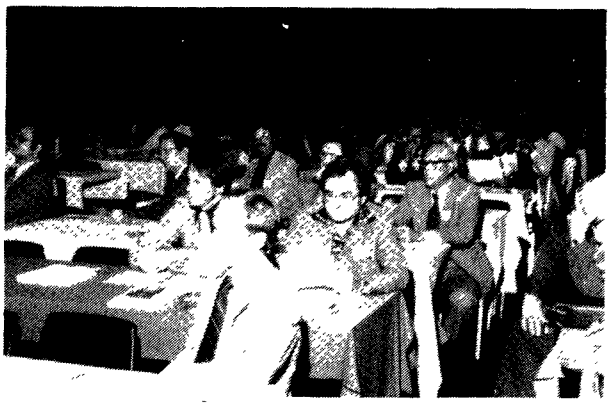

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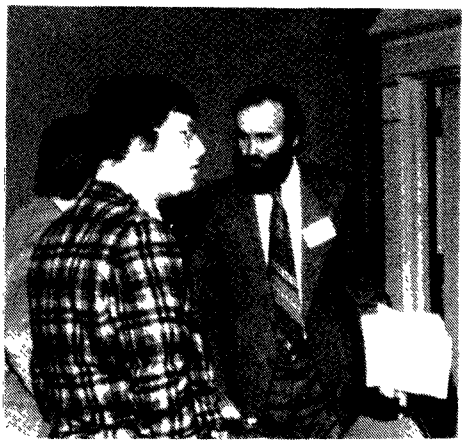


EPA Publications Get a Facelift

As you have probably already noticed, this newsletter is the first in Technology Transfer's line of publications to adopt the new EPA graphic standards

The EPA is undertaking a program to enhance its visual image and provide the public with quick and easy identifiers of its different program areas and their appropriate publications.

The following are specific program area, color and graphic identifiers:

Noise	Noise Yellow	
Toxic Substances	Toxic Red	
Radiation	Radiation Red	
Technology Transfer	Technology Purple	
Air	Air, EPA Blue	
Water	Water, Blue	
Research & Development	R&D, EPA Green	
Pesticides	Pesticides Green	
Solid Waste	Solid Waste Brown	

In the coming year, those of you who use EPA publication notice the gradual compliance by the different programs ar eventually all EPA publications will become easily identifia by color and graphic design.

Technology Transfer will be using the new standards with new publications and as reprints are made of existing pub cations, they will take on the new look described above. Th most notable change will occur in the Process Design Manuals which have become affectionately known as the "EPA Blue Books" by many of the engineers and scientists who utilize them in day to day work. They will adopt the n standard in appearance and will from now on be purple ar white in color rather than the traditional blue.

It is hoped that these rather small changes will help you t better use the information developed through all of EPA's programs.

Seminar on Combined Sewer Overflow Assessment and Control Procedures

Technology Transfer and EPA Region I sponsored a seminar held at the Howard Johnson Convention Center near Hartford, Connecticut on May 18 and 19, 1978.

The seminar was designed to present EPA policy for funding combined sewer overflow (CSO) projects, and the techniques and treatment systems that are available for assessment and control of stormwater discharges. Simplified techniques that can easily be used by the engineering profession wer emphasized. Subject areas included: 1) identifying objectiv and benefits from CSO controls, 2) analyzing the existing collection system, 3) estimating the quantity and quality of combined sewer discharges, 4) CSO treatment methods a sludges generated as a result of combined sewer discharg control.

Additional seminars in this series are scheduled for Seattl Washington on June 28 and 29 and Chicago, Illinois on July 26 and 27, 1978.

National Conference on Livestock Waste Management

The Environmental Research Information Center cosponsored this conference with: USEPA Robert S. Kerr Environmental Research Laboratory, Ohio State University, and the U.S. Department of Agriculture. The conference was held in Columbus, Ohio on May 23 and 24, 1978.

The conference presented state-of-the-art information developed through research and development grants and demonstration projects on assessment, treatment and disposal of animal wastes.

Topics covered were the impact of grazing on soil and vegetation and the resultant water quality effects from these activities; description and economic analysis of each of the common waste management systems for small-scale confined animal production facilities; and animal waste utilization on crop and pastureland including quantity and characteristics of animal wastes, loading rates for various crops and soil conditions, and pollutant loads from surfac run-off and groundwater leaching.

A workshop for identifying future research needs in the areas of animal waste pollution assessment and control, and animal waste as a resource for energy and nutrients followed the conference.

;ourses Offered roubleshooting O & M Problems

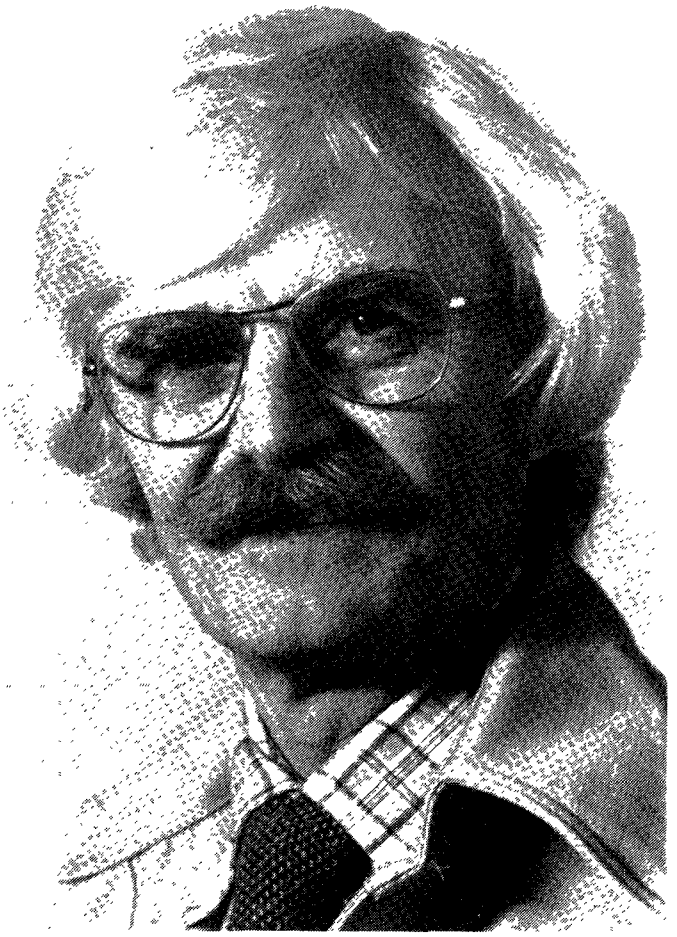
vo five-day short courses on Troubleshooting O & M oblems at Municipal Wastewater Treatment Facilities will held on August 14-18, 1978 in Cincinnati, Ohio and on eptember 18-22, 1978 in Denver, Colorado. These courses e sponsored by the Environmental Resources Training enter, Southern Illinois University at Edwardsville and the S Environmental Protection Agency. Each course is an ensive five-day workshop on identification and solution O & M related problems which affect the performance id efficiency of treatment works. A systematic procedure r evaluating treatment works, for identifying O & M re- ed problems, and probable causes, for developing alterna- e solutions, and for selecting and implementing the eferred solution will be presented. The course will be taught as a workshop and uses comprehensive case histories of problem situations. All treatment processes are covered with primary emphasis placed upon biological treatment systems and solids handling/disposal All instructors are experienced in plant operations and in troubleshooting.

The course is designed for consulting engineers and plant operations specialists who are responsible for plant start-up, O & M manual preparation, treatment system evaluation and in-plant technical assistance to retainer clients. Treatment System managers, supervisors and senior operations personnel will benefit from the course.

Registration fee for the course is $200. Registration is limited to 32 trainees per location. For additional information contact Dr. James O. Bryant, Jr., Director, Environmental Resources Training Center, Southern Illinois University, Campus Box 75, Edwardsville, IL 62026.

Memoriam

February, William Bishop, Technology Transfer's Regional airman and Team Leader of Research and Development in gion IX, passed away. Bill was a graduate of Case Institute Technology in Cleveland, Ohio where he received a B.S. in vil Engineering ('54), an M.S. in Sanitary Engineering ('57) d a Ph.D. in Sanitary Engineering ('62). He worked for *gineering Science* from 1962 to 1967 at which time he ent to work for the Federal Water Quality Administration WQA). A licensed professional engineer in both California d Ohio, Bill became Technology Transfer's Regional Chair- an in January 1975. The engineering and scientific mmunity is always in need of quality professionals like l Bishop. Those who worked closely with him will miss his raordinary warmth, dedication, intelligence, and integrity.



ENVIRONMENTAL RESEARCH INFORMATION CENTER
1978 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 the previous section of this newsletter.

SUBJECT	DATE	REGION/LOCATION
Pretreatment	June 27-28, 1978	IV Atlanta
Pretreatment	July 12-13, 1978	VI Dallas
Pretreatment	August 8-9, 1978	II New York
Pretreatment	August 30-31, 1978	V Chicago
Pretreatment	September 13-14, 1978	VII Kansas City
Pretreatment	October 18-19, 1978	I Boston
Pretreatment	November 1-2, 1978	VIII Denver
Pretreatment	December 5-6, 1978	X Seattle
Sludge Treatment & Disposal	June 14-15, 1978	VII Kansas City
Small Wastewater Flows	June 21-22, 1978	II New Jersey
Small Wastewater Flows	September 6-7, 1978	V Minnesota
Combined Sewer Overflows	June 28-29, 1978	X Seattle
Combined Sewer Overflows	July 25-26, 1978	V Chicago
National Conf.—Lake Restoration	August 22-24, 1978	V Minneapolis

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
I	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.)
II	Robert Olson	Environmental Protection Agency 26 Federal Plaza New York, New York 10007 212 264-1867 (N.Y., N.J , P.R., V.I.)
III	Albert Montague	Environmental Protection Agency 6th & Walnut Streets Philadelphia, Pennsylvania 19106 215 597-9856 (Pa., W. Va., Md., Del., D.C., Va.)
IV	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.)
V	Clifford Risley	Environmental Protection Agency 230 S. Dearborn Street Chicago, Illinois 60604 312 353-2200 (Mich., Wis., Minn., Ill., Ind., Ohio)
VI	Mildred Smith	Environmental Protection Agency 1201 Elm Street First International Building Dallas, Texas 75270 214 749-3971 (Texas, Okla., Ark., La., N. Mex.)
VII	John Coakley	Environmental Protection Agency 1735 Baltimore Avenue Kansas City, Missouri 64108 816 374-5971 (Kansas, Nebr., Iowa, Mo.)
VIII	Elmer Chenault	Environmental Protection Agency 1860 Lincoln Street Denver, Colorado 80203 303 837-4343 (Colo., Mont., Wyo., Utah, N.D. S.D.)
IX	Fred Hoffman	Environmental Protection Agency 215 Fremont Street San Francisco, Calif. 94105 415 556-6925 (Calif., Ariz., Nev., Hawaii)
X	John Osborn	Environmental Protection Agency 1200 6th Avenue Seattle, Washington 98101 206 442-1296 (Wash., Ore., Idaho, Alaska)

ENVIRONMENTAL RESEARCH INFORMATION CENTER

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- Monitoring
- Analytical Methods
- Quality Control
- Remote Sensing
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- Potable Water Supply
- Solid Wastes
- INDUSTRIAL
- Wastewater
- Air
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- Energy Aspects

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ENVIRONMENTAL RESEARCH INFORMATION CENTER
TECHNOLOGY TRANSFER
PUBLICATIONS

☆ U. S GOVERNMENT PRINTING OFFICE 1978-757-140/6820 Region No. 5-11

REQUEST FOR TECHNOLOGY TRANSFER MATERIAL

The publications listed on this form are the only ones available through the Office of Technology Transfer.

Please send me the following publications at no charge. (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 ☐

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 ☐
- Dry Caustic Peeling of Clingstone Peaches . . . .2005 ☐
- 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, Minn.* . . . .2015 ☐

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. . . . .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 Dentrification 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 . . . . .4011 ☐

BROCHURES

- Logging Roads and Water Quality. . . . .5011 ☐
- 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 ☐

HANDBOOKS

- Analytical Quality Control in Water and Wastewater Laboratories (1972) . . . .6001 ☐
- Monitoring Industrial Wastewater (1973) . . . .6002 ☐
- Methods for Chemical Analysis of Water and Wastes (1974). . . .6003 ☐

INDUSTRIAL ENVIRONMENTAL POLLUTION CONTROL MANUALS

- Pulp and Paper Industry – Part 1/Air . . . .7001 ☐

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 still 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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•Publication listed for the first time.

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TECHNOLOGY TRANSFER

The Bridge Between Research and Use

U.S. ENVIRONMENTAL PROTECTION AGENCY JANUARY 1978

50th ANNUAL-WPCF CONFERENCE, PHILADELPHIA

The Water Pollution Control Federation celebrated its 50th year October 2-7, 1977 at the Philadelphia Civic Center in Philadelphia, PA with the largest conference ever, attracting almost 10,000 attendees, assembled to sit in on the numerous technical sessions and visit the display area well represented by industry, professionals and for the eighth straight year the Environmental Protection Agency.

This year, six programs within EPA combined efforts in forming a single exhibit for distributing publications and giving the attendees a centralized area for meeting EPA personnel for information exchange. The six programs staffing the exhibit were: the Environmental Research Information Center (ERIC); Operation and Maintenance; Manpower Planning and Training; Effluent Guidelines; Construction Grants; and 208 Water Quality Management.

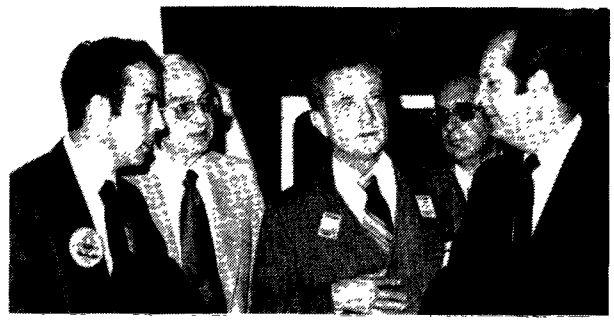
Each of the six programs offered publications and written material for distribution and supplied qualified personnel to answer questions fielded by the attendees according to the program area.

For this year's WPCF conference, ERIC's Technology Transfer program featured the latest Process Design Manual (number eight in the series) on "Land Treatment of Municipal Wastewater." This manual is designed to give the user the most comprehensive design information on the subject of land treatment compiled under one cover to date. ERIC representatives distributed over 3800 manuals to the attendees during the week long conference

A highlight for this year's WPCF exhibit area was a visit by the EPA Administrator, Douglas Costle, and Thomas Jorling, EPA Assistant Administrator for Water and Hazardous Materials, who visited many of the exhibits and talked with various attendees.

Because of the number of EPA publications involved in this year's exhibit, many were not immediately available at the conclusion of the conference, however, each can be obtained by contacting the appropriate programs listed in this article.

(left to right) Robert E. Crowe, Director, U.S. EPA, ERIC; Dorothy Williams, U.S. EPA, ERIC; and Douglas Costle, Administrator, U.S. EPA, during the recent WPCF conference in Philadelphia.



(left to right) Dr. James E. Smith Jr., U.S. EPA, ERIC; Richard S. Engelbrecht, WPCF, President-Elect; John T. Rhett, U.S. EPA, Deputy Assistant Administrator for Water Programs Operations; Carmen Guarino, Philadelphia Water Department and Douglas Costle, U.S. EPA Administrator discuss the 1977 WPCF on the exhibit floor.

(left to right) Richard S. Engelbrecht, WPCF President-Elect; Carmen Guarino; Phila. Water Dept. and Thomas Jorling, U.S. EPA, at the EPA referral room which attracted many of the conference attendees.

LOOK ON PAGE 11 FOR IMPORTANT MESSAGE

CAPSULE REPORT FOR UTILITY FABRIC FILTER BAGHOUSES NOW AVAILABLE

EPA's Industrial Environmental Research Laboratory in Research Triangle Park, N.C. has funded projects to analyze the performance of two of the first coal-fired powerplants equipped with fabric filters, located at Nucla, Colorado and Sunbury, Pennsylvania.

The Nucla fabric filtration facility was designed to control the entire particulate load from the three stoker-fired boilers of the 39 Mw facility. The installation has been able to meet the Colorado air pollution regulations with ease.

The Sunbury baghouse replaced an electrostatic precipitator collection system which was unable to meet the particulate control efficiency required by state regulations. The replacement bag system has met the Pennsylvania regulations since its initial operation in 1973.

The capsule report summarizes performance and cost data for the two facilities. This report can be obtained by checking the appropriate box (#2013) on the order form in the back of the newsletter.

SECOND POLLUTION CONTROL SEMINAR SCHEDULED FOR THE PRIMARY FOREST PRODUCTS INDUSTRY

The second seminar discussing the primary forest products industry will be held in Portland, Oregon, April 4-6, 1978 at the Sheraton-Lloyd Center. This seminar will focus on environmental problems and solutions for the primary wood products industry in the Pacific Northwest. This includes sawmills, veneer and plywood mills, hardboard mills, and all timber operations. Major topic areas include non-point source, air, and water sessions.

The Forest Products Research Society is co-ordinating the meeting with the Environmental Research Information Center. For further information and a registration form, contact Ms. Connie Walling, FPRS, 2801 Marshall Court, Madison, Wisconsin 53705, telephone no. (608) 231-1361.

"ENVIRONMENTAL SAMPLING OF THE PARAHO OIL SHALE RETORT PROCESS" Featured at the 36th Exposition of Chemical Industries

The Environmental Research Information Center's Technology Transfer Program participated in the 36th Exposition of Chemical Industries held at McCormick Place, Chicago, Illinois, December 5th - 8th.

The second in the series of Executive Briefing reports entitled, "Environmental Sampling of the Paraho Oil Shale Retort Process at Anvil Points," was made available for the first time at the Chem Show. This executive briefing (a joint effort of ERIC and the Fuels Technology Branch of the Industrial Environmental Research Laboratory — Cincinnati), presents a project, which now has been completed at the U.S. ERDA Anvil Points Experimental Station, at an estimated cost of 7.5 million to the 17 members of the Paraho Oil Shale Demonstration, Inc. The Paraho Process is one of several under serious consideration for oil extraction on a commercial basis.

This executive briefing report can be obtained by checking the appropriate box (#9002) on the order form in the back of this newsletter.

NEW SEMINAR HANDOUT: "STATUS OF OXYGEN-ACTIVATED SLUDGE WASTEWATER TREATMENT"

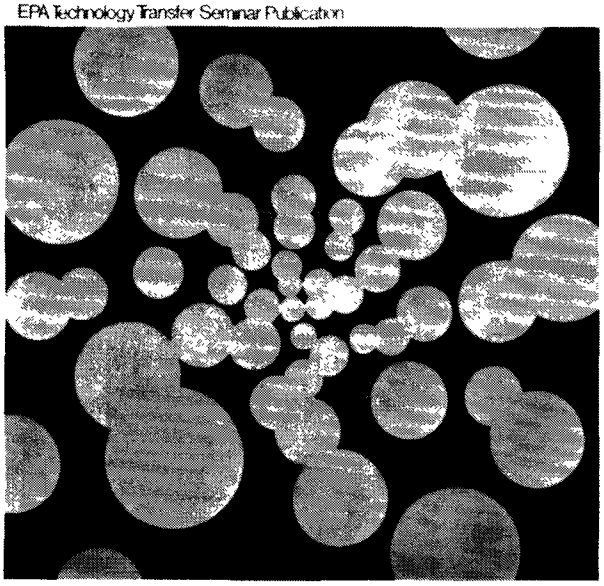
The Technology Transfer seminar publication entitled "Oxyen-Activated Sludge Wastewater Treatment Systems," first published in 1973, has been replaced by a new publication on the subject: "Status of Oxygen-Activated Sludge Wastewater Treatment." This new document (prepared by Richard C. Brenner, U.S. EPA, Municipal Environmental Research Laboratory) 1) provides an updated status report on the number and type of oxygen-activated sludge

facilities in operation, under construction, and being designed; 2) describes in detail the latest EPA supported oxygenation research and demonstration project, an evaluation of the RAD version of the open reactor system being carried out at the Metropolitan Denver, Colorado Sewage Treatment Plant; and 3) summarizes design, operating, and performance information for several on-line oxygen wastewater treatment systems.

This publication can be obtained by checking the appropriate box (#4003) on the order form on the back of the newsletter.

Status of Oxygen-Activated Sludge Wastewater Treatment

EPA Technology Transfer Seminar Publication



REGIONAL IRRIGATION WATER QUALITY CONTROL CONFERENCE

Technology Transfer, EPA Region X and the Idaho, Oregon and Washington state water quality agencies sponsored a conference held in Boise, Idaho on December 8 and 9, 1977 and devoted to water quality control for irrigated agriculture.

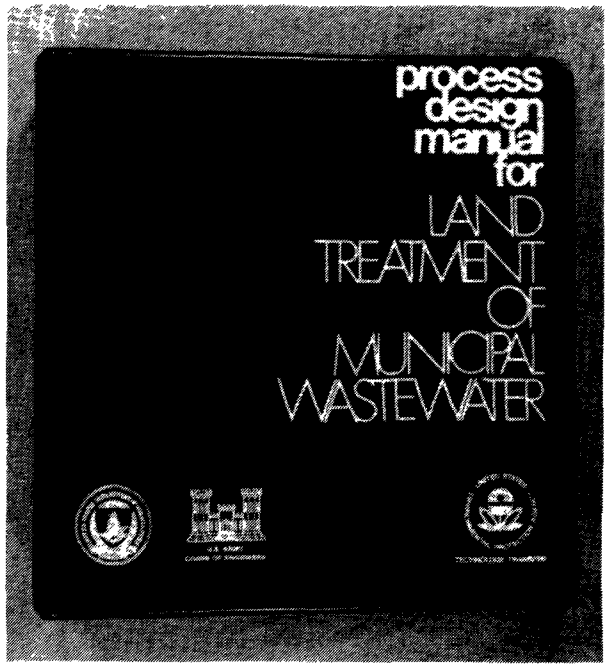
The conference presented the latest tools and concepts that have been developed through research and demonstration projects managed by the EPA Robert S. Kerr Laboratory, Ada, Oklahoma. These were designed to implement programs of irrigation return flow water quality management.

Conference attendees were from irrigation districts, agriculture extension service offices, conservation districts, and state and federal agencies dealing with agriculture and water pollution control. The audience also included 208 planners, agriculturalists, and personnel from water management agencies Presentations were made in the subject areas of sediment, nutrient, pesticide and salinity pollution control from irrigation return flows, in addition to progress made in implementing the procedures developed. The goal of the conference was to assist in implementing 208 planning programs which modify irrigation practices to improve water quality.

NEW PROCESS DESIGN MANUAL LAND TREATMENT OF MUNICIPAL WASTEWATERS

The Process Design Manual for Land Treatment of Municipal Wastewater (a joint effort of EPA, Army Corps of Engineers, and Dept. of Agriculture) is available through Technology Transfer. This manual presents a rational procedure for the design of land treatment systems. Flow rate, rapid infiltration, and overland flow processes for the treatment of municipal wastewaters are given emphasis. The basic unit operations and unit processes are discussed in detail, and the design concepts and criteria are presented The manual includes design examples as well as actual case study descriptions of operational systems. Information on planning and field investigations is presented along with the process design criteria for both large and small scale systems.

This manual was introduced at the October WPCF conference in Philadelphia and those unable to obtain a copy then can do so by checking the appropriate box (#1008) on the order form in the back of this newsletter.

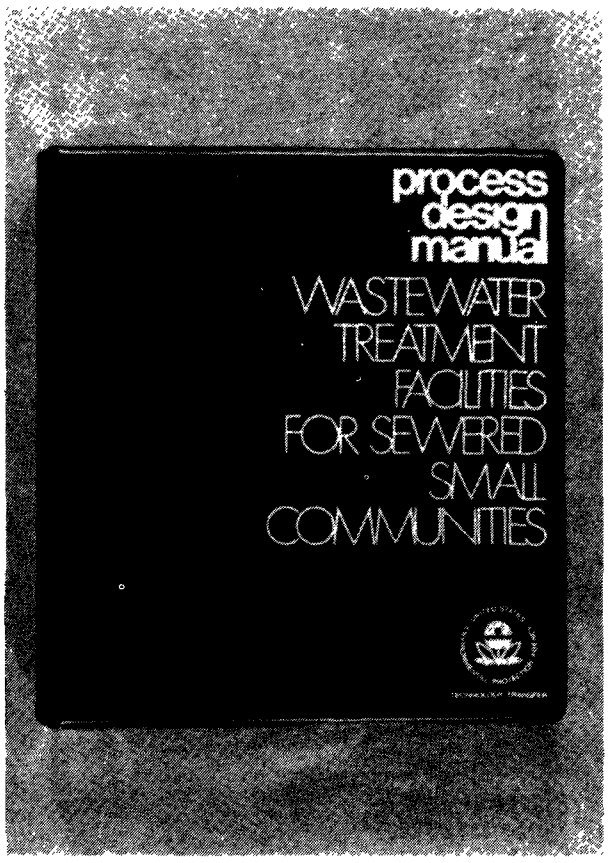


NEW PROCESS DESIGN MANUAL: WASTEWATER TREATMENT FACILITIES FOR SEWERED SMALL COMMUNITIES

A new Technology Transfer Process Design Manual presenting information for the planning, design and operation of present and future wastewater treatment facilities for *sewered* small communities is now available.

The manual addresses such topics as flow equalization, package plants, treatment ponds, nutrient removal, and sludge handling, with specific emphasis on application at small plants (less than 1 mgd). There are also chapters on Operation and Maintenance and Cost Effectiveness.

Prepared by Camp, Dresser & McKee, this manual can be obtained by checking the appropriate box (#1009) on the order form in the back of this newsletter.

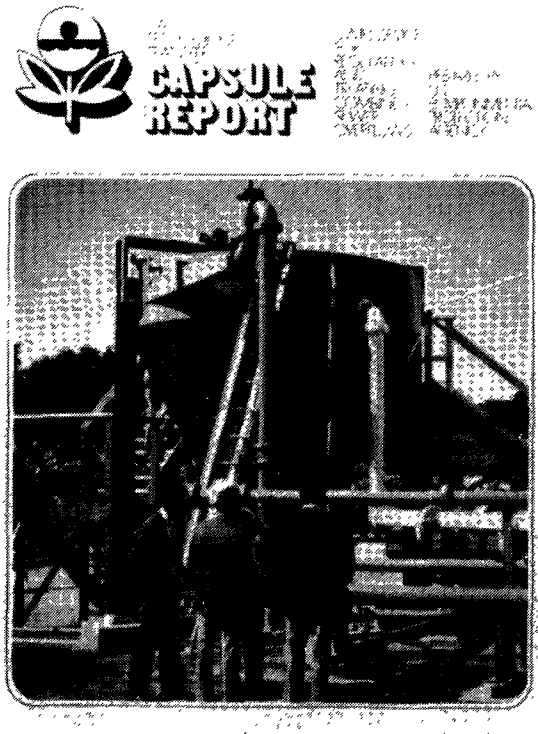


FIRST CAPSULE REPORTS IN MUNICIPAL AREA PUBLISHED

The first three Technology Transfer Capsule Reports dealing with municipal pollution control technology have been printed and are now available. They are.

- Swirl Device for Regulating and Treating Combined Sewer Overflows (#2012) - This Capsule Report describes the results of a full-scale prototype SWIRL unit that controlled real overflows in Syracuse, N.Y., and discusses other areas of application.
- First Progress Report on Static Pile Composting of Wastewater Sludge (#2014) - Static pile composting and its application to the municipalities of Bangor, Maine, and Durham, New Hampshire are described.
- Efficient Treatment of Small Municipal Flows at Dawson, Minnesota (#2015) - The Dawson project demonstrated that small plants can provide highly reliable and efficient removal of BOD and SS, and consistent nitrification.

These publications can be obtained by checking the appropriate boxes on the order form in the back of this newsletter. Additional Capsule Reports in the municipal area are being prepared and their availability will be announced in this newsletter.



NEW SEMINAR PUBLICATION: "ALTERNATIVES FOR SMALL WASTEWATER SYSTEM"

A new publication developed for the Technology Transfer Seminar Series for Design of Small Wastewater Treatment Systems has been printed and is now available for distribution. This 3-volume document includes sections on Pressure Sewers, Vacuum Sewers, On-Site Disposal, Septage Treatment and Disposal, and Cost/Effectiveness Analysis. Design information, cost data, and case-history material are included for each of these subject areas.

Authors of this document are James F. Kreissl, U S. EPA-MERL, Cincinnati, Ohio; Joseph Rezek and Ivan Cooper of Rezek, Henry, Meisenheimier & Gende, Libertyville, Illinois; William Boyle, Richard Otis, James Converse, and Jerry Tyler, University of Wisconsin-Madison; and Jerrold Troyan, Brown & Caldwell, Eugene, Oregon.

This publication can be obtained by checking the appropriate box (#4011) on the order form in the back of the newsletter.

HAWAII CONFERENCE ON 208 WATER QUALITY MANAGEMENT PLANNING

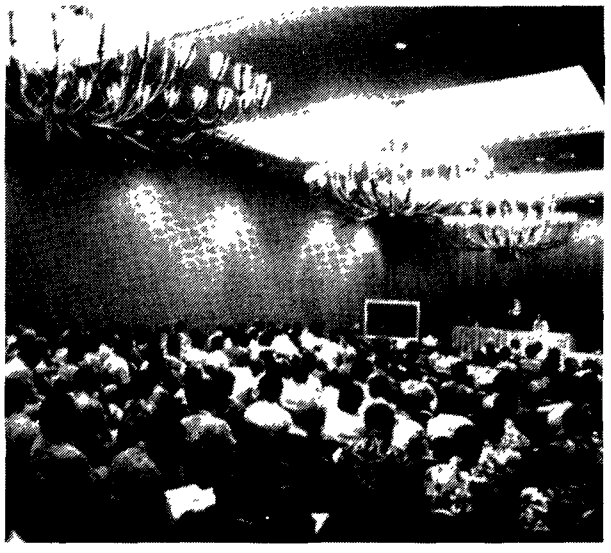
On October 18 and 19, 1977 in Honolulu, Hawaii, Technology Transfer, EPA Region IX and the Hawaii Department of Health sponsored a conference on Section 208 Water Quality Management Planning.

The purpose of this two day conference was to bring to the Pacific Islands information and data that are both necessary and useful in the preparation and implementation of a Section 208 planning program. Attending were representatives from Hawaii, Guam and Mariana Islands Trust Territory 208 agencies, Federal, state and local government, consulting firms, industry and agriculture, and 208 advisory committees. A total of 22 speakers gave presentations on regulatory and institutional considerations, control of nonpoint sources of pollution from construction and agricultural operations, assessment and control of urban stormwater runoff, and water conservation and residue management. The conference was followed by a one day workshop devoted to urban stormwater runoff. The workshop provided the opportunity for indepth discussions of monitoring, assessment, evaluation and selection of control alternatives.

Dr. James S. Kumaga, Deputy Director for Environmental Programs, Hawaii Dept. of Health

James Thompson, Chief
Pacific Islands Branch, U.S. EPA Region IX

Registration Desk



Pacific Ball Room, Ilikai Hotel

TECHNOLOGY TRANSFER CONTINUES MUNICIPAL DESIGN SEMINAR SERIES ON SLUDGE TREATMENT AND DISPOSAL

Four seminars were held on sludge treatment and disposal during 1977 in Newark, New Jersey; Salt Lake City, Utah; Atlanta, Georgia and Boston, Massachusetts respectively. They were very well attended and many new regional requests were received. Plans have been made to have five sludge seminars during 1978, and a schedule appears below.

Schedule

March 30 & 31, 1978	Philadelphia, Pa.
April 20 & 21, 1978	Los Angeles, California
May 3 & 4, 1978	Portland, Oregon
June 14 & 15, 1978	Kansas City, Mo.
July 12 & 13, 1978	Dallas, Texas

The basic program will be similar to that described in the June 1977 Technology Transfer Newsletter. Some changes, however, have been necessitated. The seminar handout will contain a greater body of knowledge, which will come from a more detailed review of the literature, company files and site visits to acquire first hand performance, cost and energy data. Where possible European and Japanese developments will be included. The handout material will have a detailed and worked out design example for each of the various processing steps. Presentations will emphasize and almost exclusively include the development of the design example.

TECHNOLOGY TRANSFER ANNOUNCES SEMINARS ON MUNICIPAL PRETREATMENT GUIDELINES FOR INDUSTRIAL EFFLUENTS

The exact format and content of these seminars are presently in preparation The pretreatment seminars are geared for consulting engineers, municipal design engineers and federal and state pollution control officials concerned with pollution control and abatement. In addition, industrial pollution control officials will also find the content of the seminars most helpful. It is anticipated that the seminars will be two days in length with one day dealing with the municipal side and the other with industrial concerns. Some of the subjects covered in the seminar that are of concern to municipalities are:

a. Developing an inventory of industrial and commercial wastes being introduced into a publicly owned treatment works;
b. Determining removals of pollutants in the publicly owned treatment works;
c. Designing a monitoring enforcement program;
d. Determining the treatment works tolerance to pollutants which interfere with its operation;
e. Obtaining the technical information necessary to support development of an industrial waste ordinance;
f Obtaining equipment necessary to monitor industrial wastes; and
g. Constructing facilities necessary to monitor industrial wastes.

Subjects covered of interest to industrial attendees include:

a Determining user charges and industrial cost recovery,
b. Choosing financial assistance;
c Selecting the most cost effective pretreatment technologies

All ten regions will be impacted by this seminar series and the first two are listed below:

April 5-6	Boston, Massachusetts
April 26-27	Dallas, Texas

NEW ENVIRONMENTAL MONITORING PUBLICATION AVAILABLE

A new ERIC-Technology Transfer document in the Environmental Monitoring series entitled, "Sampling of Water and Wastewater," has been published

This document describes the state-of-the art of commercially available and custom built automatic liquid samplers, with recommended sampling procedures for the field to be used by persons engaged in water quality surveys as a guide to achieve uniformity and quality control in water monitoring programs.

The document will be distributed by ERIC on a limited basis. However, it will be available to the public through the National Technical Information Service.

WORKSHOP ON MICROBIAL DEGRADATION OF POLLUTANTS IN MARINE ENVIRONMENTS

A workshop will be held in Gulf Breeze, Florida from April 10 through 14 to provide a comprehensive review of concepts on microbial degradation processes with application to the fate of organic pollutants in marine environments. Emphasis will be placed on the recalcitrance of certain chemical structures as identified in the laboratory with pure cultures of bacteria and fungi, review of established laboratory degradation processes for aquatic environments including parameter measurements, and information review

of laboratory models used to study microbial degradation processes. One of the major objectives of this symposium will be to help clarify and consolidate concepts of biodegradation by providing direction to future research as well as presenting a base of information which industry and government can use in the development and regulation of chemicals.

This workshop will be jointly sponsored by EPA's Environmental Research Information Center, Office of Pesticide programs and the Environmental Research Laboratory at Gulf Breeze, Florida. If interested in attending this workshop contact Doug Williams of the E R.I C staff in Cincinnati at (513) 684-7394.

POLLUTION IMAGINEERING CONFERENCE

The EPA and the U.S. Department of Commerce co-sponsored a two day conference in San Francisco, Dec. 1-2 at the Sheraton Palace. The conference, co-ordinated through the Environmental Research Information Center, emphasized industry's examples of integrating pollution control into corporate management philosophy. It represented a new era of co-operation between government and industry to conserve natural resources and develop cleaner, more cost effective industrial processes

Highlights of the conference included an address by Douglas Costle, EPA administrator and Anne Wesler, DOC Deputy undersecretary.

Major contributors to the conference included Paul DeFalco Jr , EPA Region IX Administrator, Leonard Saari, DOC Region X Secretarial Representative; Allen Haile, DOC Region IX Secretarial Representative and Donald Dubois, EPA Region X Administrator.

QUARTERLY REPORT AVAILABLE ON FLUE GAS DESULFURIZATION

EPA has sought to enhance the reliability and effectiveness of flue gas desulfurization (FGD) technology by sponsoring and conducting programs for the research, development, and demonstration of FGD. The comprehensive involvement of EPA in these programs has made evident the need for systematic, timely mechanisms for communicating FGD results to industry. The need for a quarterly report summarizing recent progress in FGD technologies was identified; and thus, the *FGD Quarterly Report* was born.

The *FGD Quarterly Report* has four major objectives: (1) to disseminate information concerning EPA sponsored and conducted research, development, and demonstration projects; (2) to provide updates of on-going contracts; (3) to provide the interested reader with sources of more detailed data; and (4) to report the final results of various studies.

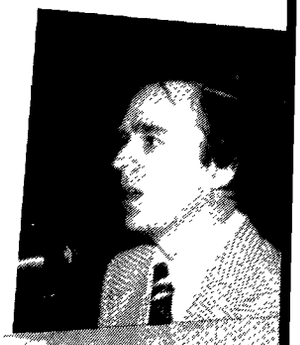
To receive a free subscription to the *FGD Quarterly Report* send your request to: J. David Mobley MD-61, Industrial Environmental Research Laboratory-RTP, U.S. Environmental Protection Agency, Research Triangle Park, N.C. 27711.

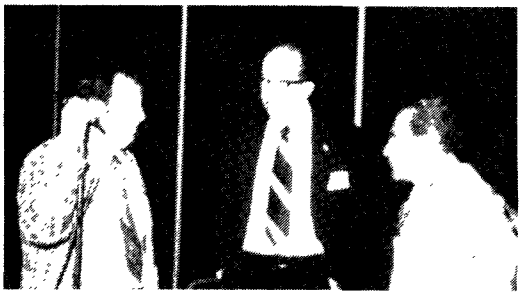
DESIGN SEMINARS FOR SMALL WASTEWATER TREATMENT SYSTEMS CONTINUED

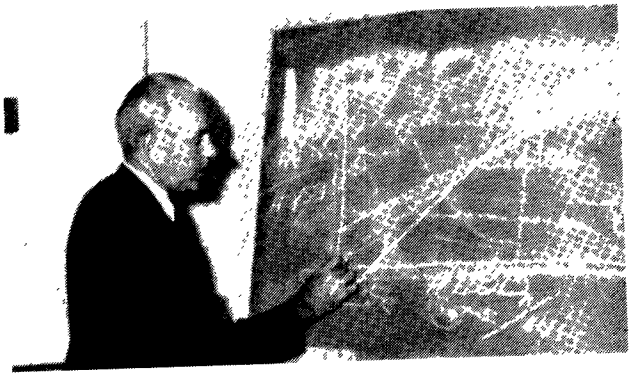
As a result of the response to last year's series, five additional Technology Transfer Design Seminars for Small Wastewater Treatment Systems have been scheduled for FY1978. Dates and locations for these seminars are:

Dates	Region/City
January 10-11	V - Columbus, OH
February 1-3	II - San Juan, PR
March 7-8	X - Boise, ID
June 7-8	II - Princeton, NJ
September 13-14	V - Minneapolis, MN

Please contact the appropriate Regional Technology Transfer Committee Chairman listed in the back of the newsletter for details regarding registration at these seminars.







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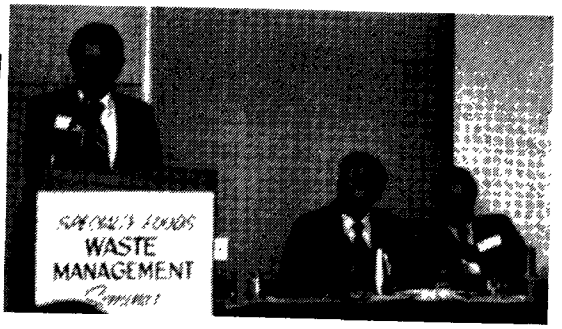
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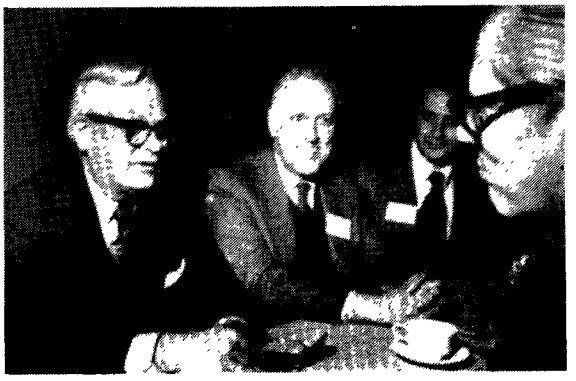

ENVIRONMENTAL RESEARCH INFORMATION CENTER
1978 SEMINAR SCHEDULE

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 the previous section of this newsletter.

SUBJECT	DATE	REGION/LOCATION
Small Wastewater Treatment Systems	Jan. 10-11	V - Holiday Inn/Across from Ohio State University, Columbus, Ohio
Asphalt Industry	Jan. 12-13	IV - Holiday Inn Airport, Tampa, Florida
Asphalt Industry	Jan. 26-27	IX - Hyatt Regency, Phoenix, Arizona
Small Wastewater Treatment/Sludge Treatment & Disposal	Feb. 1, 2, 3	II - San Juan, Puerto Rico
Asphalt Industry	Mar. 1-2	V - Stouffers Cincinnati Towers Cincinnati, Ohio
Small Wastewater Treatment Systems	Mar. 7-8	X - Boise, Idaho
Sludge Treatment & Disposal	Mar. 30-31	III - Philadelphia, Pa.
Forest Industry	Apr. 4-5	X - Sheraton-Lloyd Center Portland, Oregon
Pretreatment	Apr. 5-6	I - Boston, Massachusetts
Concepts in Microbial Degradation National Conference	Apr. 12-14	IV - Pensacola, Florida
Sludge Treatment & Disposal	Apr. 20-21	IX - Los Angeles, California
Pretreatment	Apr. 26-27	VI - Dallas, Texas

ATTENTION

ECHNOLOGY TRANSFER READERS

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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 your EPA Regional Technology Transfer Committee Chairman from the list below.

REGION	CHAIRMAN	ADDRESS
I	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.)
II	Robert Olson	Environmental Protection Agency 26 Federal Plaza New York, New York 10007 212 264-1867 (N.Y., N.J., P.R., V I.)
III	Albert Montague	Environmental Protection Agency 6th & Walnut Streets Philadelphia, Pennsylvania 19106 215 597-9856 (Pa., W Va., Md., Del , D.C., Va.)
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TECHNOLOGY TRANSFER
PUBLICATIONS

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The publications listed on this form are the only ones available through the Office of Technology Transfer.

Please send me the following publications at no charge. (Check appropriate boxes)

PROCESS DESIGN MANUALS

- Phosphorous 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 ☐

TECHNICAL CAPSULE REPORTS

- Recycling Zinc in Viscose Rayon Plants . . . . . .2001 ☐
- Color Removal from Kraft Pulping Effluent by Lime Addition . . . . . .2002 ☐
- Pollution Abatement in a Copper Wire Mill . . . . . .2003 ☐
- First Interim Report on EPA Alkali SO_2 Scrubbing Test Facility . . . . . .2004 ☐
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- SO_2 Scrubbing and Sulfuric Acid Production Via Magnesia Scrubbing . . . . . .2007 ☐
- Second Interim Report on EPA Alkali Scrubbing Test Facility . . . . . .2008 ☐
- Magnesium Carbonate Process for Water Treatment . . . . . .2009 ☐
- Third Interim Report on EPA Alkali Scrubbing Test Facility . . . . . .2010 ☐
- First Progress Report Wellman-Lord Flue Gas Desulfurization . . . . . .2011 ☐
- SWIRL Device for Regulating and Treating Combined Sewer Overflows . . . . . .2012 ☐
- •Fabric Filter Particulate Controls on Coal-Fired Utility Boilers: Nucla, CO. and Sunbury, PA. . . . .2013 ☐
- First Progress Report on Static Pile Composting of Wastewater Sludge . . . . . .2014 ☐
- Efficient Treatment of Small Municipal Flows at Dawson, Minn. . . . . .2015 ☐

INDUSTRIAL SEMINAR PUBLICATIONS

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BROCHURES

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- Municipal Wastewater Alternatives . . . . . .5012 ☐
- Forest Harvesting and Water Quality . . . . . .5013 ☐

HANDBOOKS

- Analytical Quality Control in Water and Wastewater Laboratories (1972) . . . . . .6001 ☐
- Monitoring Industrial Wastewater (1973) . . . . . .6002 ☐
- Methods for Chemical Analysis of Water and Wastes (1974) . . . . . .6003 ☐

INDUSTRIAL ENVIRONMENTAL POLLUTION CONTROL MANUALS

- Pulp and Paper Industry — Part 1/Air . . . . . .7001 ☐

EXECUTIVE BRIEFINGS

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LAND TREATMENT MANUAL TO BE FEATURED AT 1977 WPCF CONFERENCE

ERIC is once again participating in the Annual Conference and Exhibition of the Water Pollution Control Federation. This year's conference - WPCF's 50th - is being held in Philadelphia, October 2-7, 1977. The Regional Administrator for EPA Region III is Jack J. Schramm and the Regional Technology Transfer chairman is Albert Montague.

For this year's meeting, six EPA programs concerned with wastewater pollution control have worked together to develop one major EPA exhibit. These programs are: ERIC, Effluent Guidelines, 208 Planning, Construction Grants, Municipal Operations, and Training. In addition to the exhibit, a referral room has been set up to handle distribution of publications from each of the programs. Personnel from each of the programs will be available at the exhibit and in the referral room to answer questions, discuss EPA policy, etc.

The Process Design Manual for Land Treatment of Municipal Wastewater (a joint effort of EPA, Army Corps of Engineers, and Dept. of Agriculture) will be made available for the first time at the WPCF Conference. This manual presents a rational procedure for the design of land treatment systems. Flow rate, rapid infiltration, and overland flow processes for the treatment of municipal wastewaters are given emphasis. The basic unit operations and unit processes are discussed in detail, and the design concepts and criteria are presented. The manual includes design examples as well as actual case study descriptions of operational systems. Information on planning and field investigations is presented along with the process design criteria for both large and small scale systems.

We invite you to visit the EPA exhibit (Booth No. 953) and Referral Room (Booth No. 1304).

ERIC's exhibit at last year's WPCF's Annual Conference held in Minneapolis, Minn.

EPA'S RESEARCH AND DEVELOPMENT REPORT IN WASTEWATER DISINFECTION

Introduction

The program for disinfection is directed toward development of methodology for destruction of pathogens that is safe from the standpoint of public health and is environmentally acceptable. Documentation of results in the form of symposia, regional seminars, technical publications, and a Design Manual will be delivered. The effort is being directed primarily to municipal design engineers to allow them to make rational decisions regarding selection and design of disinfection processes. Present practice has been to duplicate old designs because a familiar data base of experience existed.

Both in-house pilot and extramural field scale evaluations are being utilized to improve disinfection technology. Studies concern chlorine, chlorine dioxide, dechlorination, ozone, and ultraviolet light. Emphasis is being placed on contacting efficiency, chemical utilization, capital and operating costs, and efficiency. In order to guage environmental acceptability, toxicity and chemical side product formation are being investigated.

Objectives

The primary objective of the Wastewater Disinfection Program is to protect the public

health from the spread of disease by controlling the point-source discharge of pathogenic microorganisms and viruses. This objective is achievable. Pursuant to that goal, the disinfection processes to be developed must not be inherently toxic to the receiving water flora and fauna. Furthermore, formation of by-products potentially toxigenic to man must be minimized.

The Municipal Environmental Research Laboratory (MERL) Wastewater Disinfection Program, under the direction of Mr. Albert D. Venosa, is organized to investigate all aspects explicit and implicit in the above-stated objective. Optimization of the chlorination process and development of cost-effective alternatives are being pursued vigorously. Direct quantification of the effect of the various disinfection processes on pathogenic microorganisms and naturally occuring viruses is being carried out. Some of the volatile and non-volatile organic constituents of wastewater effluents which have been disinfected by various means are being evaluated, to provide an initial assessment of the potential human toxigenicity of each disinfection system.

State of Art

Regulation Changed

On July 26, 1976, the EPA officially deleted the fecal coliform standard from the Secondary Treatment Information Regulation (40 CFR 133) defining secondary treatment as mandated in Public Law 92-500. Reliance on the site-specific water quality standards of each State to set disinfection requirements for municipal wastewater treatment plants shall now be the practice. Thus, disinfection will still be required by State regulation, but no uniform Federal requirement has to be achieved.

Chlorine

Chlorination is practiced widely, but too often the practices are careless, wasteful, and inadequate. Recently, chlorine has been identified as being toxic to certain aquatic fish species at very low concentrations. Furthermore, chlorine has been implicated as a major contributing factor to the formation of compounds potentially carcinogenic to man. Nevertheless, it is a cost-effective disinfectant, and fairly precise methods of continuous feedback control are available. The most pressing need in chlorine development technology is engineering optimization. Rapid mixing of the chlorine and improved design of contact chambers to provide long contact times are essential for achieving the desired bacteriological effects and minimum residual discharge.

This need is being addressed in a project funded jointly by EPA and the State of California. An idealized chlorine mixing and contacting system is being constructed and a trailor-mounted bioassay laboratory is being prepared for use in evaluating the disinfection efficiency and reduction in toxicity emission from such an idealized system compared with full-scale chlorination facilities at several California treatment plants. Information obtained will be used to develop a manual of design and practice for wastewater chlorination systems.

An EPA-funded project with Utah State University was recently completed. This project was designed to evaluate the amenability of algae-laden lagoon effluent to chlorine disinfection. Extensive data were gathered and statistically analyzed, and a mathematical computer-based model was developed to aid consulting engineers in designing wastewater chlorination systems. The model, called Chlor I, incorporates as the most significant factors influencing disinfection efficiency the following parameters: coliform density, chlorine residual, contact time, temperature, sulfide, total chemical oxygen demand, and suspended solids.

Dechlorination

Dechlorination with sulfur dioxide, which is practiced mostly in the State of California, has been shown to eliminate the toxic effects of residual chlorine to aquatic species. Methods are available to control sulfur dioxide dosage with fluctuations in chlorine residual. Reliability and operation and maintenance (O&M) costs need to be determined. A potential drawback with sulfur dioxide dechlorination is that if dosage control is not precise, an excess amount may cause a depression in pH and dissolved oxygen. In the latter case, reaeration would be necessary, resulting in an increase in disinfection cost.

A study is underway with the Los Angeles County Sanitation District to evaluate efficiency and reliability of sulfur dioxide dechlorination at one or more California treatment plants currently utilizing the process. Parameters to be investigated include total and fecal coliform densities at the outfall and downstream from the discharge, dosage requirements, chlorine residual before SO_2 injection, pH and dissolved oxygen before and after SO_2 injection, and reaeration requirements. The method of feed forward control, requiring two continuous residual chlorine analyzers, will be thoroughly evaluated for reliability.

Ozone

Ozone appears to be the most promising alternative to chlorine. Several full-scale wastewater ozonation facilities are in the design stages, under construction, or already on-line in the U.S. Ozone is non-toxic to aquatic organisms, is a good virucide, and contributes to high dissolved oxygen levels in the treated effluent. Its major drawback is the relatively high cost of generation. Furthermore, because of the short half-life of ozone in aqueous solution and its extremely low partial pressure, gas-liquid contacting must be

efficient. Thus, there is a pressing need to improve the economics of ozone generation and to develop design guidelines for efficient gas-liquid contacting.

In response to these needs, several projects are underway. At the Upper Thompson Sanitation District, Estes Park, Colorado, the cost-effectiveness of ozone generated from air, using a water-cooled, corona-discharge ozone generation system, is being investigated on a full-scale, tertiary treatment plant effluent. The ozone contractor is a covered, sparged diffuser chamber, baffled to provide over-and-under serpentine flow hydraulics. At the Mahoning County Sanitation District, Youngstown, Ohio, the cost-effectiveness of ozone generated from pure oxygen, using an air-cooled, corona-discharge ozone generation system, is being investigated in like manner. The contactor is a positive pressure injection system. Results from these two projects will provide the necessary comparative cost-effectiveness information to aid design engineers in choosing the best means of wastewater disinfection suitable for specific needs.

At EPA's Environmental Research Center, Cincinnati, Ohio, an in-house study is being conducted to optimize contacting of ozone with wastewater. Several generic-type contactors are being evaluated in parallel for disinfection efficiency and optimum ozone utilization. Parameters being investigated include total fecal coliforms, fecal streptococci, *Salmonella* spp., physical-chemical characterization parameters (COD, TSS, turbidity, Fe, Mn, pH, temperature, etc.), ozone concentrations in the gas streams and in the liquid, electrical power levels, and various liquid/gas flow ratios. A comprehensive design manual will result at the completion of the experimental phase of work.

The popularity of ozone in the U.S. is on the upswing. Several treatment plants utilizing ozone for disinfection are being started up this year in addition to those mentioned above. They include: Springfield, Missouri; Potomac Heights, Maryland; and Santa Clara, California; Woodlands, Texas and Indiantown, Florida are already in operation. Concord, North Carolina, Murphreesboro, Tennessee, and Pensacola, Florida are under construction, and at least 12 more plants are known to be in the design stages.

Ultraviolet Light

Ultraviolet light is another promising alternative to chlorine. Ultraviolet has been demonstrated to be feasible under certain conditions, but reliability is hampered by wastewater quality and inadequate design. Because UV is not itself a chemical agent, there is no lasting, toxic residual imparted to the treated effluent. However, certain chemical compounds may be altered by UV radiation, resulting in a possible source of chemical contamination. Most UV units available on the market are designed for treating potable water. It is only recently that equipment manufacturers have focused their attention on wastewater applications.

In recently completed project with the City of Dallas, Texas, ultraviolet transmissability of the wastewater was shown to increase with nitrification. Since a nitrified effluent will contain lower levels of soluble organic compounds which would absorb UV, improved UV light transmission would result in such an effluent and consequently better disinfection would be achieved. Indeed, a direct correlation was found between mean log coliform reduction and percent transmittance at fixed operational conditions. An inverse relationship was found between mean log coliform reduction and wastewater flow rate, indicating, as expected, that if the intensity is fixed, better disinfection will occur at longer detention times.

These and other effects will be studied and quantified in greater detail in a project recently funded at the University of North Carolina, Chapel Hill. Two generic type ultraviolet units will be compared under identical conditions to provide much needed design information. The thin film, high UV intensity, short detention time concept will be compared with the thicker water wall, lower intensity, longer detention time concept. In addition, the effects of filtration and cleaning frequency will be intensively evaluated, as well as UV intensity monitoring to establish proper dosage criteria. The sensitivity of poliovirus to ultraviolet exposure will be compared with that of coliform bacteria.

A full-scale demonstration project on ultraviolet disinfection was recently funded at the Northwest Bergen County Sewer Authority, Waldwick, New Jersey. A 30,000 m^3/day (8 mgd) prototype ultraviolet system will be tested on a full-scale conventional activated sludge effluent to obtain cost-effectiveness data on UV disinfection. Reliability of achieving the desired coliform reduction, maintenance requirements, and electrical power needs are the key factors under investigation. This project and the Chapel Hill project are both scheduled for completion by early 1979. Interim reports will be made available as progress ensues.

Chlorine Dioxide

Chlorine dioxide (ClO_2) technology for wastewater treatment is in its infancy. Like ozone, ClO_2 must be generated on site, and the methods available are energy intensive. An advantage of ClO_2 is the fact that formation of halogenated organic compounds does not take place to any appreciable extent. Safety and handling precautions are at least as great as the precautions with chlorine.

A project is being funded at Stanford University to evaluate the feasibility of wastewater disinfection with chlorine dioxide. A survey of the experience with the use of ClO_2 in water treatment practice in Europe and the U.S., and an evaluation

of the applicability of that experience to wastewater disinfection are planned. Existing manufacturing processes and the potential for scale-down will be evaluated. A design concept for a reactor system will be formulated and tested in the laboratory. Effects of ClO_2 on production of chlorinated organic compounds will also be tested. Completion of this project is scheduled for mid-1979.

Other Research Projects Funded by EPA

As stated earlier, one of the objectives of the MERL Wastewater Disinfection Program is to minimize the spread of communicable disease in the environment while at the same time minimizing the formation of by-products potentially toxigenic to man. Thus, when considering alternatives to chlorine, the effects of such alternatives on viruses and on chemical reactions in the wastewater must be assessed. Two projects are underway to evaluate these effects.

An Interagency Agreement with the Energy Research and Development Administration (ERDA), utilizing personnel at the Oak Ridge National Laboratory, has been funded in which assessment of the formation of non-volatile organic compounds in wastewater exposed to chlorine, ultraviolet light, and ozone will be made. Furthermore, the mutagenicity of the non-volatile organic constituents and their disinfection reaction products will be assessed using bacteria and mammalian test species. Project duration is 18 months.

The other study is a grant with the Carborundum Company to determine whether chlorine, ozone, and ultraviolet light are effective under actual operating conditions in achieving natural virus inactivation in secondary and advanced wastewater treatment plant effluents. Two Aquella™ virus concentrators are being used to process all samples in the field. Concomitant runs will be made during each operating day: one sampling prior to disinfection and the other subsequent to disinfection. Project duration will be approximately 1.5 years.

Thus, the MERL Wastewater Disinfection Program is actively and earnestly pursuing all aspects of the field. A wastewater disinfection symposium is planned in late Fiscal Year 1978 to present the findings from most of the projects mentioned above. There will, in addition, be numerous interim and final reports appearing in the upcoming months as more and more data are gathered, analyzed, and evaluated. The objectives stated at the beginning of this report will be achieved and a safer environment will be ensured.

Recent Results from In-House Ozone Contactors Disinfection Study

Recently, the first phase of the in-house ozone contactor study was completed. A packed column, which is serving as the base unit to which all other contactors will be compared, was evaluated in parallel with a jet scrubber. The latter is an atomizer-type contactor manufactured by R. P. Industries under the trade name Dynactor. The research was performed at MERL's experimental activated sludge pilot plant located in Cincinnati, Ohio.

The characteristics of the secondary effluent prior to ozonation during the study period are summarized in Table 1.

Table 1.
CHARACTERISTICS OF PILOT PLANT EFFLUENT PRIOR TO OZONE TREATMENT

Parameter	Mean* mg/1	Range mg/1
Temperature, °C	14	13 - 14
TCOD	76	41 - 106
SCOD	65	34 - 105
TOC	20	8 - 30
TSS	6	2 - 11
Turb, JTU	11 3	1 6 - 40
TKN	16 0	6 5 - 27
NH_4+-N	8 6	3 6 - 14 1
Organic-N	7 4	2 2 - 30 5

* 24 Data Points

Testing was performed according to a predetermined factorial arrangement, called a "split-split-plot design." Secondary effluent was pumped to each ozone contactor at a rate of 75l/min, while ozone gas, generated from air at a constant concentration of approximately 10 mg ozone/l air, was fed to both contactors at various gas flow rates. Dosage was determined by multiplying the concentration of ozone in the inlet gas by the ratio of the gas to liquid flow rates. Four different pre-selected dosage levels were used, and grab samples of ozonated wastewater from both contactors were taken for bacteriological and chemical analysis. Both contactors received the same dosage at any given time, but the order in which the four dosage levels were applied in any given experiment was randomized. Each entire experiment was considered a "whole plot" and was replicated on six different days (R_i). The "split-plot" consisted of the four dosage levels (D_j) within a replicate experiment, and the "split-split-plot" consisted of the two contactors (C_k) compared at each dosage level within each replicate experiment. The basis of comparison was disinfection efficiency, defined as total and fecal coliform log reduction (log No/N, where No = total or fecal coliform MPN before ozonation, and N = total or fecal coliform MPN after ozonation), because achievement of target coliform standards (i.e., 1000 total coliforms/100 ml or 200 fecal coliforms/100 ml) does not account for the initial number of coliforms present in the wastewater prior to ozonation.

Data analyses were facilitated by an IBM 370 computer, using a standard Biomed Package program BMD 02V (Analysis of Variance for Factorial Design). In each analysis of variance

(ANOVA) there were three "main affects" (i.e., C_k, D_j, and R_i) "under investigation, and two interaction effects" (i.e. R_iC_k, and DjC_k). The contactor main effect (C_k) tested the difference in total or fecal coliform log reduction (TCLR or FCLR) between the two contactors. The dose main effect (D_j) tested the effect of ozone dosage on the performance of both contactors. The replication main effect (R_i) tested the effect of different days on the performance of both contactors. Since the only variable which changed from day to day was wastewater quality, R_i actually tested the effect of wastewater quality on contactor performance. The contactor-dosage interaction effect (D_kD_j) tested whether the difference in performance between the two contactors was consistent or changed at each dosage level. Finally, the contactor-replication interaction effect (C_kR_i) tested whether the difference in performance between the two contactors was consistent or changed from day to day. Because of the nature of the factorial design used in this study, the R_iD_j and the $R_iD_jC_k$ interations could not be tested.

In addition to the ANOVA's described above, data were further subjected to linear regression analyses to evaluate the effects of the wastewater quality characteristics, individually or in concert, on the selected performance criteria.

Results

The data for total coliform log reduction (TCLR) in both contactors are presented in Table 2, and the analysis of variance of those data is illustrated in Table 3. The fecal coliform data are not presented because the results were similar to the TCLR data.

Table 2.
SPLIT-SPLIT-PLOT LAYOUT FOR
TOTAL COLIFORM LOG REDUCTION DATA

Replicates (days)	Packed Column (TCLR)				Jet Scrubber (TCLR)			
	Dose, mg/1				Dose, mg/1			
	4 9	9 7	13 1	19.5	4 9	9 7	13 1	19 5
1	2 03	3 09	4.15	3.14	1.00	1 86	3.00	2 52
2	1 00	2 15	2 22	2.00	1 00	0 30	0.07	0 31
3	2 00	2 46	3 35	2.86	0.14	1 79	2 54	2 27
4	1 00	3.02	3 22	3.31	0 16	0 81	0.91	2 16
5	0 03	0.85	1 35	4.02	0.00	0.03	0 00	2 48
6	0 24	1.16	1.27	3 43	0 07	0 43	0 03	1 16
Mean	1 05	2.12	2 59	3 13	0.40	0 87	1 09	1 82
Standard Deviation	0 84	0.94	1 17	0 67	0 47	0 78	1 35	0 89

If the computed F-statistic in Table 3, with the appropriate degrees of freedom, is greater than the corresponding F-value from the F-Distribution table [significance level (α) = 0.05], the effect under examination is significant. The various F-statistics were computed as follows: (1) Dose main effect (D_j) - the mean square (MS) for doses was ratiod against the MS for the R_iD_j interaction, (2) Replication main effect (R_i) - the MS for replication was ratiod against the MS for the R_iD_j interaction; (3) C_kD_j interaction effect - the MS for the C_kD_j interaction was ratiod against the MS for the $R_iD_jC_k$ interaction; (4) C_kR_i interaction effect - the MS for the CkRi interaction was ratiod against the MS for the $R_iD_jC_k$ interaction. To test for a significant difference between the two contactors (contactor main effect), a Pseudo-F test was performed in which the mean square (MS) for contactors (C) was ratiod against the MS for the R_iC_k interaction plus the MS for the D_jC_k interaction minus the mean square for the $R_iD_jC_k$ interaction.

Table 3.
ANOVA OF TOTAL COLIFORM
LOG REDUCTION DATA

Source of Variation	Degrees of Freedom	Sums of Squares	Mean Squares	F	F (α= 0 05)
Contactors (C_k)	1	16 697	16 697	51 8	37 0
Doses (D_j)	3	19 141	6 380	7.9	3 29
Replicates (R_i)	5	17 920	3 584	4 45	2 90
C_kD_j	3	1 203	0 401	1 70	3 29
C_kR_i	5	0 788	0 158	0 67	2 90
$R_i D_j$	15	12 067	0 804		
$R_i D_j C_k$	15	3 543	0 236		
Total	47	71.359			

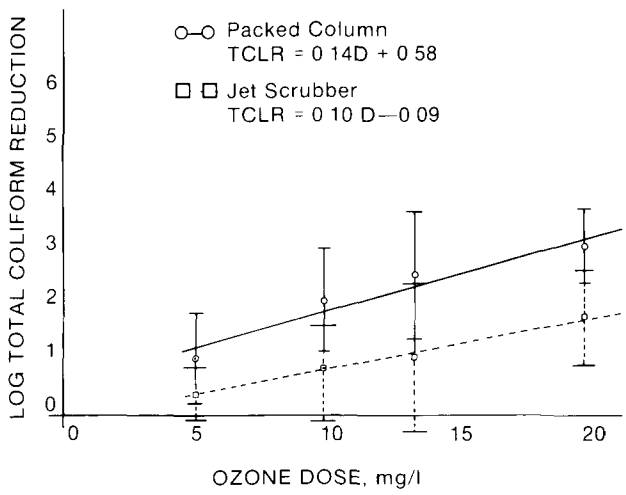
Results from Table 3 indicate the following: (1) significant contactor main effect (C_k) - this means that the packed column was significantly different from the jet scrubber with respect to TCLR as a result of ozonation. (2) Significant dosage main effect (D_j) - this means that TCLR in both contactors was significantly affected by the magnitude of the applied ozone dosage. (3) Significant replication main effect (R_i) - this means that disinfection in both contactors was significantly affected by wastewater quality. (4) No contactor-dosage interaction (C_kDj) - this means that the magnitude of the difference in TCLR between the packed column and the jet scrubber was consistent at all dosage levels studied. (5) No contactor-replication interaction - this means that the magnitude of the difference in TCLR between the packed column and the jet scrubber was consistent regardless of the quality of the wastewater.

The relationship between TCLR and applied ozone dose in each contactor is depicted graphically in Figure 1. Each point is the mean of the six replicate experiments, while the vertical lines define the standard deviations. The regression equations are illustrated in the legend.

It is evident that the packed column was superior to the jet scrubber (contactor main effect) with respect to TCLR and that TCLR in both contactors was directly proportional to dosage (dosage main effect). The wide standard deviation limits depict the effect of wastewater quality on

the performance of both contactors (replication main effect). The ANOVA in Table 3 revealed that there was no significant interaction between contactor performance and dosage (C_kDj). This means that the slopes of the regression equations in Figure 1 are not significantly different. Thus, not only did the packed column outperform the jet scrubber with respect to TCLR, but also that difference was constant at each dosage level studied.

Figure 5-1
LOG TOTAL COLIFORM REDUCTION AS A FUNCTION OF OZONE DOSE IN THE PACKED COLUMN AND JET SCRUBBER



The data from Table 2 were subjected to linear regression analyses to determine which factors in the wastewater contributed to the variation in the total coliform reduction data at each dosage level. Correlations between TCLR and each wastewater quality variable at each dosage level in the packed column are summarized in Table 4.

Table 4.
CORRELATION OF TOTAL COLIFORM LOG REDUCTION IN THE PACKED COLUMN AT DIFFERENT OZONE DOSAGE LEVELS WITH WASTEWATER QUALITY VARIABLES

Correlation Coefficients (r)*

	O_3 Dose, mg/1			
Variable	4 9	9 7	13 1	19 5
TCOD	-0 963	-0 843	-0 979	0 215
SCOD	-0.958	-0.910	-0 970	0 143
TOC	-0 900	-0.676	-0 939	0 185
TSS	-0.832	0.102	-0.294	0 640
TKN	0 765	0 438	0.162	-0.875
TURB	-0 105	0.031	-0 111	-0 711
NH_4^+—N	0.869	0 718	0.817	-0 247
ORG-N	0 381	0 132	-0 078	-0 884

*6 replicate data points used to derive each r-value

Any correlation coefficient (r-value) in Table 4 greater than 0.73 indicates TCLR is positively affected by the wastewater quality variable, while an r-value less than -0.73 indicates TCLR is adversely affected by the variable.

The data in Table 4 indicate that total chemical oxygen demand (TCOD), soluble chemical oxygen demand (SCOD), and total organic carbon (TOC) significantly and adversely affected disinfection efficiency in the packed column at ozone dosage levels ranging from 4.9 to 13.1 mg/1. At 19.5 mg/1 TCLR was no longer affected by changes in TCOD, SCOD, or TOC. Conversely, total Kjeldahl nitrogen (TKN) and organic nitrogen did not significantly affect disinfection efficiency in the packed column until the ozone dosage was 19.5 mg/1. These observations suggest that disinfection efficiency in the packed column was not mass transfer limited, because the magnitude of the TCLR at each dosage level was dependent on the concentration of organic material present in the wastewater.

Results from the jet scrubber were similar, except that no significant correlations between TCLR and TCOD, SCOD, TOC, TKN or organic-N were found at the lowest dosage (4.9 mg/1) or the highest dosage (19.5 mg/1). The reason for the lack of correlation at the low dosage level was that very little disinfection occured anyway. Disinfection at the highest dosage level may have been mass transfer limited.

The two ozone contactors were also evaluated from an ozone utilization standpoint, but space limitation preclude a detailed discussion in this bulletin. A final report will be published shorlty, describing the findings from this study in a comprehensive manner. The investigation will now focus attention on other generic type contactors, so that eventually design guidelines for ozone contacting devices can be published to aid consulting engineers in designing the most cost-effective ozonation system that present technology will permit.

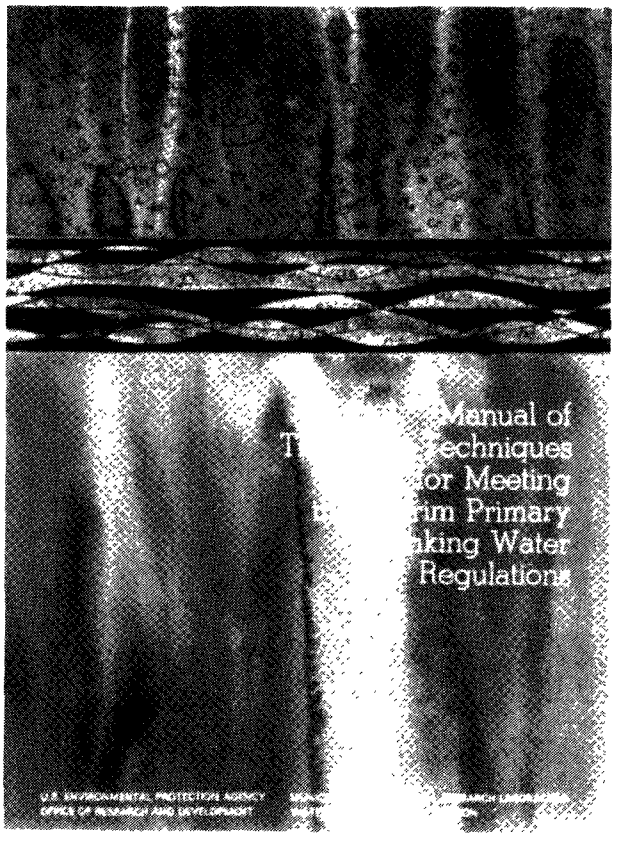
ASPHALT INDUSTRY SEMINAR SERIES SCHEDULED

ERIC has subcontracted JACA Corp. to conduct a series of seminars discussing the environmental problems in the asphalt industry. The seminars will be held in early 1978; tenative sites are Phoenix, Arizona, Salt Lake City, Utah, Tampa, Florida, and Cincinnati, Ohio. The conferences will be co-sponsored by EPA, NAPA (National Asphalt Pavement Association) and APCA (Air Pollution Control Association).

There are over 1500 automated, stationary, and portable hot mix asphalt plants in the country, with an average of 3.5 employees per plant. This series of seminars will be especially beneficial to the smaller plant owner or operator needing assistance with air and water pollution requirements.

ERRATA SHEET FOR "MANUAL OF TREATMENT TECHNIQUES FOR MEETING INTERIM PRIMARY DRINKING WATER REGULATIONS"

With the pending implementation of the Interim Primary Drinking Water Regulations, the Municipal Environmental Research Laboratory's Water Supply Research Division published a booklet entitled "Manual of Treatment Techniques for Meeting the Interim Primary Drinking Water Regulations," EPA-600/8-77-005 in May 1977. An errata sheet for this booklet has been prepared and is available. Persons who obtained the treatment manual at the 1977 AWWA Annual Convention or at one of the Technology Transfer Seminars on Designing and Upgrading Drinking Water Treatment Systems may wish to obtain the errata sheet. Requests should be directed to the Water Supply Research Division, Municipal Environmental Research Laboratory, USEPA, 26 West St. Clair Street, Cincinnati, Ohio 45268.

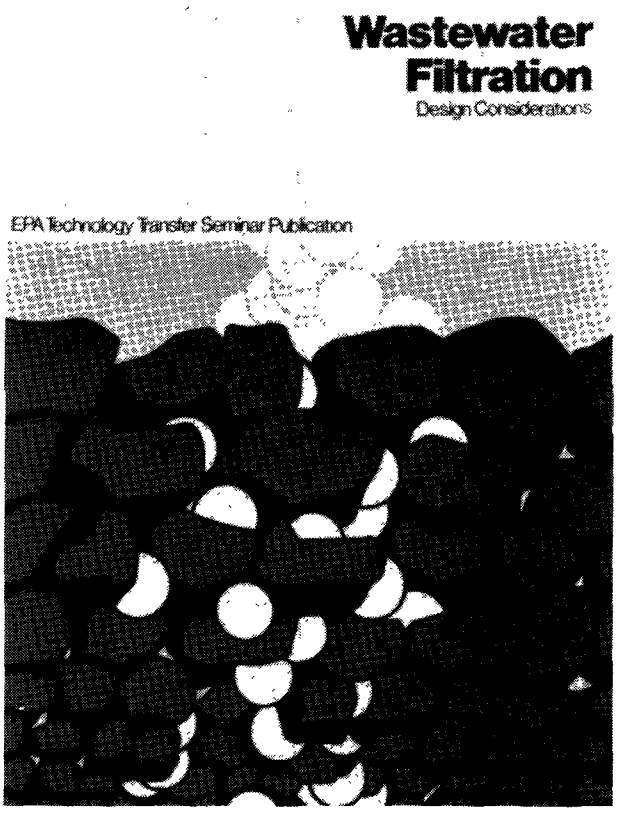


"WASTEWATER FILTRATION" SEMINAR HANDOUT REVISED

The Technology Transfer seminar publication entitled "Wastewater Filtration," originally published in July 1974, has been revised and is available upon request. The revision includes an update on Filter Design Considerations and results from pilot scale testing. Also included is a summary of performance data for wastewater filtration.

This publication was revised by John L. Cleasby, E. Robert Baumann, and Anson Marston, Iowa State University, all of whom contributed to the preparation of the original version.

This revised publication can be obtained by checking the appropriate box (#4007) on the order form in the back of this newsletter.



THE PRACTICAL ASPECTS OF COAL MINING RECLAMATION AND POLLUTION CONTROL

Over 180 mining representatives attended a 2-day seminar, "The Practical Aspects of Coal Mining Pollution Control," held in Zanesville, Ohio on July 19 and 20, 1977. The seminar was co-sponsored by U.S. EPA—Cincinnati, the Co-operative Extension Service—Ohio State University, Ohio Department of Natural Resources—Division of Reclamation and Division of Soil and Water Districts, Ohio Environmental Protection Agency, Ohio Federation of Soil and Water Districts, Ohio Mining and Reclamation Association, and U.S. Department of Agriculture—Soil Conservation Service.

The seminar was designed for the participants and attendees to exchange and share information on current practices for defining and controlling coal mining pollution. The topics presented included information on the working role of the involved organizations, Pre-planning considerations, Techniques and Practices for Sedimentation and Erosion Control During Mining and After Extraction—Reclamation. This seminar was the second in the series of Coal Mining Pollution Control seminars.

DESIGN SEMINARS FOR SMALL WASTEWATER TREATMENT SYSTEMS

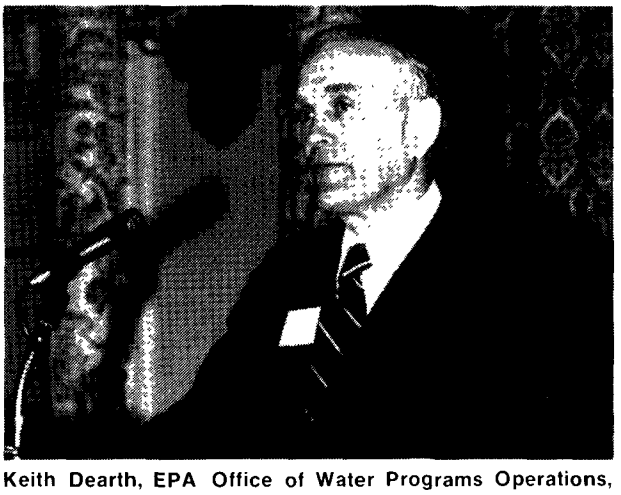
Technology Transfer conducted the last scheduled Design Seminar on Small Wastewater Treatment Systems for FY 1977 in Syracuse, New York, September 7-8, 1977

This seminar series has been one of Technology Transfer's most successful and will have been presented in all ten geographical regions, including Seattle, Philadelphia, Kansas City, Concord, San Francisco, Denver, Atlanta, Chicago, Dallas, and finally Syracuse

Contributing to the success of this seminar series by their timely and pertinent presentations were Gordon Culp and H. H Benjes, Clean Water Consultants; Richard Otis, William Boyle, Jerry Tyler, and James Converse, University of Wisconsin; Joseph Rezek and Ivan Cooper, Rezek, Henry, Meisenheimer and Gende; Joseph Middlebrooks and James Reynolds, Utah State University; Jerry Troyan, Brown and Caldwell; William Bowne, Douglas County, Oregon, and James Kreissl, U.S. EPA, Cincinnati, Ohio.

Material presented at these seminars is currently being edited for bulk publication and distribution. Notice of availability of these documents will appear in this newsletter.

Gary Plews, State of Washington, speaking at Seattle Design Seminar for Small Wastewater Treatment Systems.



Keith Dearth, EPA Office of Water Programs Operations, Washington, D.C. addressing the attendees at the Seattle Design Seminar for Small Wastewater Treatment Systems.

James F. Kreissl, U.S. EPA, Municipal Environmental Research Laboratory, Cincinnati, Ohio, during Technical Session on Alternative Collection Systems at Design Seminar for Small Wastewater Treatment Systems.

FIRST CAPSULE REPORTS IN MUNICIPAL AREA PUBLISHED

The first three Technology Transfer Capsule Reports dealing with municipal pollution control technology have been printed and are now available. They are:

- Swirl Device for Regulating and Treating Combined Sewer Overflows (#2012) - This Capsule Report describes the results of a full-scale prototype SWIRL unit that controlled real overflows in Syracuse, N.Y., and discusses other areas of application.
- First Progress Report on Static Pile Composting of Wastewater Sludge (#2014) - Static pile composting and its application to the municipalities of Bangor, Maine, and Durham, New Hampshire are described
- Efficient Treatment of Small Municipal Flows at Dawson, Minnesota (#2015) - The Dawson project demonstrated that small plants can provide highly reliable and efficient removal of BOD and SS, and consistent nitrification.

These publications can be obtained by checking the appropriate boxes on the order form in the back of this newsletter. Additional Capsule Reports in the municipal area are being prepared and their availability will be announced in this newsletter

INDUSTRIAL INITIATIVES CONFERENCE

Methods for reducing industrial pollution and achieving substantial cost benefits at the same time was the focus of a top-level government/industry conference in Boston, June 8th and 9th, at the Boston Park Hotel. It was patterned after the very successful Chicago conference in January.

This unique conference brought together members of Congress, executives from leading corporations and top federal, state and local government officials to discuss a variety of new and important pollution control issues and technologies

An audience of 250 were at the workshops covering specific technical approaches, including the key elements of selecting and managing a pollution abatement program The conference was sponsored by Region I and ERIC, in cooperation with the U S Department of Commerce, state manufacturing associations and Chambers of Commerce from Massachusetts, Maine, Rhode Island, Vermont, New Hampshire and Connecticut

EPA Administrator Douglas Costle addresses the Boston EPA/DOC Conference audience.

Sid Galler, DOC Deputy Assistant Sec'y discusses incentives to improving industrial pollution control.

Jack Bays of Coors points out resource recovery methods in the brewing industry.

EPA's OPERATION AND MAINTENANCE RESEARCH PROGRAM IS GAINING MOMENTUM

The Operation and Maintenance Program within the Municipal Environmental Research Laboratory in Cincinnati has made significant progress in accomplishing its overall objectives of demonstrating methods, processes and procedures for improved operaion and maintenance of municipal wastewater treatment plants during the past two years

One of the major objectives of this program is to identify, evaluate, quantify and document factors contributing to poor municipal treatment plant performance This effort is being accomplished by a three and one-half year, two-phase National O&M cause and effect survey concentrating on plants located in the eastern and western sections of the United States. The two-years first phase of this project has recently been completed whereby 180 half-day to one-day plant site visits and 60 three- to five-day comprehensive plant evaluations were completed by two contractors. Phase I survey results have identified and quantified the impact of over sixty different factors affecting plant performance. These factors were grouped into four major categories (administration, maintenance, design and operation) and were evaluated using a ranking and weighting table developed as a part of this project. Adverse factors at all facilities evaluated were ranked in order of frequency and severity of occurrence The highest ranking factor identified was "operator application of concepts and testing to process control."

Based on observations noted during the first phase effort, recommendations were made in the areas of technical assistance, training,incentives, staffing, and enforcement with respect to an overall approach to improve plant operation and maintenance. Final reports describing the first

phase results will be published by November 1977 and will be available from:

U.S. EPA
Urban Systems Management Section
26 W. St. Clair
Cincinnati, Ohio 45268

Other areas of O&M program emphasis include demonstrating the cost and effectiveness of flow equalization, initiation of a four-year reliability engineering and analysis program consisting of biological, mechanical component, physical/chemical process and overall system reliability; demonstration of low-cost improved operating efficiency of groups of small municipal treatment plants through implementation of centralized management concepts, and establishment of a centralized computerized data base for storage, analysis and retrieval of field verified O&M cost, performance and reliability data.

Flow equalization research will culminate this year with the development and publication of a comprehensive flow equalization manual of practice that presents the cost and effectiveness of flow equalization based on the results of three EPA demonstration projects, one in-house pilot investigation and field operating experience from fifty full-scale flow equalization facilities.

Furture high priority activities of the O&M program will include examination of the cost benefits of novel materials and methods of construction, analysis of energy utilization of municipal treatment facilities, investigation of the O&M cost of sludge management alternatives, and O&M cost of land application systems.

NEW PROCESS DESIGN MANUAL: WASTEWATER TREATMENT FACILITIES FOR SEWERED SMALL COMMUNITIES

A new Technology Transfer Process Design Manual presenting information for the planning, design and operation of present and future wastewater treatment facilities for *sewered* small communities is now available.

The manual addresses such topics as flow equalization, package plants, treatment ponds, nutrient removal, and sludge handling, with specific emphasis on application at small plants (less than 1 mgd). There are also chapters on Operation and Maintenance and Cost Effectiveness.

Prepared by Camp, Dresser & McKee, this manual can be obtained by checking the appropriate box (#1009) on the order form in the back of this newsletter.

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 your EPA Regional Technology Transfer Committee Chairman from the list below:

REGION	CHAIRMAN	ADDRESS
I	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.)
II	Robert Olson	Environmental Protection Agency 26 Federal Plaza New, York, New York 10007 212 264-1867 (N.Y., N.J., P.R., V.I.)
III	Albert Montague	Environmental Protection Agency 6th & Walnut Streets Philadelphia, Pennsylvania 19106 215 597-9856 (Pa., W.Va., Md., Del., D.C., Va.)
IV	Asa B. Foster, Jr.	Environmental Protection Agency 345 Courtland Street, N.E. Atlanta, Georgia 30308 404 881-3454 (N.C., S.C., Ky., Tenn., Ga., Ala., Miss., Fla.)
V	Clifford Risley	Environmental Protection Agency 230 S. Dearborn Street Chicago, Illinois 60604 312 353-2200 (Mich., Wis., Minn., Ill., Ind., Ohio)
VI	Mildred Smith	Environmental Protection Agency 1201 Elm Street First International Building Dallas, Texas 75270 214 749-3971 Texas, Okla., Arl., La., N. Mex.)
VII	John Coakley	Environmental Protection Agency 1735 Baltimore Avenue Kansas City, Missouri 64108 816 374-5971 (Kansas, Nebr., Iowa, Mo.)
VIII	Elmer Chenault	Environmental Protection Agency 1860 Lincoln Street Denver, Colorado 80203 303 837-4343 (Colo., Mont., Wyo., Utah, N.D., S.D.)
IX	William Bishop	Environmental Protection Agency 100 California Street San Francisco, Calif. 94111 415 556-6925 (Calif., Ariz., Nev., Hawaii)
X	John Osborn	Environmental Protection Agency 1200 6th Avenue Seattle, Washington 98101 206 442-1296 (Wash., Ore., Idaho, Alaska)

For the following audio-visual material, please contact your Regional Transfer Chairman. (See above)

MOTION PICTURES (16mm sound)

- Richardson, Texas Project—Title: "Somebody around here must be doing something good." (15 min.)
- Phosphorus Removal (5 min.)
- Water Quality Management, Alameda Creek, Calif.—Title: "The Water Plan." (28½ min.)
- The Seattle METRO Story. (28 min.)
- "Breakthrough at Clear Lake" (28 min.)

REQUEST FOR TECHNOLOGY TRANSFER MATERIAL

The publications listed on this form are the only ones available through the Office of Technology Transfer.

Please send me the following publications at no charge. (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 . . . . . .1008 ☐
- * Wastewater Treatment Facilities for Sewered Small Communities . . . . . .1009 ☐

TECHNICAL CAPSULE REPORTS

- Recycling Zinc in Viscose Rayon Plants . . . . . .2001 ☐
- Color Removal from Kraft Pulping Effluent by Lime Addition. . . . . .2002 ☐
- Pollution Abatement in a Copper Wire Mill . . . . . .2003 ☐
- First Interim Report on EPA Alkali SO_2 Scrubbing Test Facility. . . . . .2004 ☐
- Dry Caustic Peeling of Peaches . . . . . .2005 ☐
- Pollution Abatement in a Brewing Facility . . . . . .2006 ☐
- SO_2 Scrubbing and Sulfuric Acid Production Via Magnesia Scrubbing. . . . . .2007 ☐
- Second Interim Report on EPA Alkali Scrubbing Test Facility . . . . . .2008 ☐
- Magnesium Carbonate Process for Water Treatment . . . . . .2009 ☐
- Third Interim Report on EPA Alkali Scrubbing Test Facility . . . . . .2010 ☐
- First Progress Report Wellman-Lord Flue Gas Desulfurization . . . . . .2011 ☐
- * SWIRL Device for Regulating and Treating Combined Sewer Overflows . . . . . .2012 ☐
- * First Progress Report on Static Pile Composting of Wastewater Sludge . . . . . .2014 ☐
- * Effluent Treatment of Small Municipal Flows at Dawson, Minn. . . . . .2015 ☐

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 Investments. . . . . .3005 ☐
- Erosion and Sediment Control from Surface Mining (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 (2 Vols.) . . . . . .3009 ☐

MUNICIPAL SEMINAR PUBLICATIONS

- Upgrading Lagoons . . . . . .4001 ☐
- Physical-Chemical Treatment . . . . . .4002 ☐
- Nitrification/Dentrification . . . . . .4004 ☐
- Upgrading Existing Wastewater Treatment Facilities—Case Histories. . . . . .4005 ☐
- Flow Equalization . . . . . .4006 ☐
- Wastewater Filtration. . . . . .4007 ☐
- Physical-Chemical Nitrogen Removal. . . . . .4008 ☐
- Air Pollution Aspects of Sludge Incineration . . . . .4009 ☐
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TECHNOLOGY TRANSFER

The Bridge Between Research and Use

U.S. ENVIRONMENTAL PROTECTION AGENCY JUNE 1977

NATIONAL CONFERENCES ON 208 PLANNING AND IMPLEMENTATION

Technology Transfer and the Water Planning Division of the Office of Water and Hazardous Materials, Washington, D.C., co-sponsored three National Conferences on Section 208 Planning and Implementation at Reston, Virginia, March 15-17, at Denver, Colorado, April 19-21 and at St. Louis, Missouri, May 24-26 of this year.

The objective of the conferences was to bring together in one meeting the various aspects of the 208 Areawide Water Quality Management Planning as required by Section 208 of PL 92-500. They were structured to show the interrelationship of the technical assessment and control procedures for pollutants with the institutional process that is so necessary to achieve implementation of the 208 plan.

The conference at the Sheraton Inn, Reston, Virginia (a suburb of Washington, D.C.), was 3 days in length with an attendance of over 700—the largest audience ever to attend a Technology Transfer seminar. A breakdown of the registration showed representatives from the following groups:

Walter S. Groszyk, Deputy Director, Water Planning Division, U.S. EPA, Washington, DC, at Reston 208 conference.

John A. Green, Regional Administrator, Region 8, Denver, CO, at Denver 208 conference.

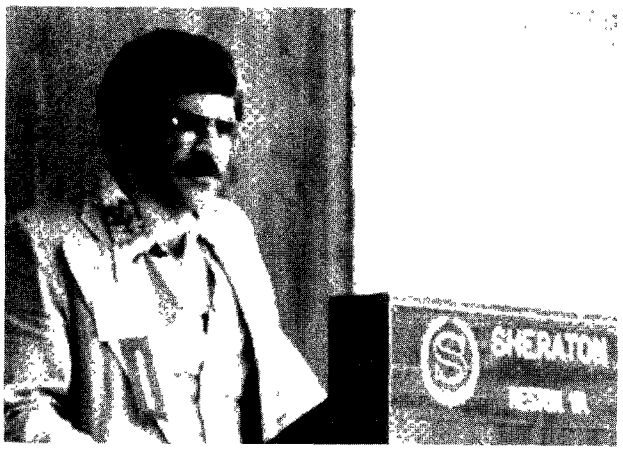
Consulting firms	172
State and local 208 agencies	157
State governments	107
Federal agencies	84
Local governments	69
Universities (students and staff)	47
Citizens organizations	31
Private industry	29
Trade organizations	18
Elected officials	3

A total of 65 speakers made presentations over the 3-day period, from: state and local 208 agencies; state water pollution control, agriculture, mining, and highway agencies; county conservation districts; state elected officials; congressional committees; conservation groups; consulting firms; universities; and federal agencies.

The first day of each conference was a general session that discussed regulatory management and institutional considerations relating to 208 planning and case studies by 208 agencies. The second day

Connie Brown, Principal Planner, Knoxville-Knox Co., Metro Planning Comm., Knoxville, TN, at Reston 208 conference.

consisted of four concurrent sessions (repeated on the third day) that presented technical assessment and control procedures for non-point-source pollutants found in urban stormwater; agriculture, silviculture, mining, and construction activities; solid waste and liquid waste sludge disposal; and septic tank discharges.



Walter Peechatka, Director, Bureau of Soil Conservation, State of Pennsylvania, at Reston 208 conference.

CURRENT STATUS OF RESEARCH IN AUTOMATION OF WASTEWATER TREATMENT IN THE UNITED STATES

During the last 15 years industry has demonstrated that automation of chemical processes is cost-effective and improves product quality. Automation of wastewater treatment and collection systems also promises improved performance at lower costs. Furthermore, with proper use of existing resources, automation can also save energy. For some unit operations requiring relatively short response times, such as automated dissolved oxygen (DO) control in activated sludge systems, cost and energy savings and performance improvements have already been demonstrated. Many wastewater treatment processes have such long response times that manual control is very effective. But, even here, automation may be beneficial because it does provide continuous control and, therefore, assures the reliability of the system.

The current status of automated control of wastewater treatment is described in this report, along with the research that has been sponsored by the U.S. EPA. The report also includes a discussion on direct digital control, and closes by discussing the research needs and problem areas.

Status of Automatic Control Applications

EPA supported a survey to evaluate the use of automatic control equipment at 50 wastewater treatment systems. Only those treatment facilities that were believed to have some degree of automation were selected for the survey.

The present use of specific types of sensors was evaluated by considering the distribution of all types of sensors in all 50 plants, as shown in Figure 1. Every plant surveyed had a device for monitoring flow. Indeed, 30 percent of all the instruments in all the plants were used for flow measurement (Figure 1). Automatic analyzers were the next highest category, probably because of the wide variety of parameters measured, including turbidity, conductivity, pH, DO, chlorine residual, and organics. The section labeled miscellaneous analyzers in Figure 1 includes devices for measurement of rotational speed, weight, position, and so forth.

The instrument performance observed during the survey was summarized according to the criteria of unsatisfactory (abandoned equipment), fair (performance con-

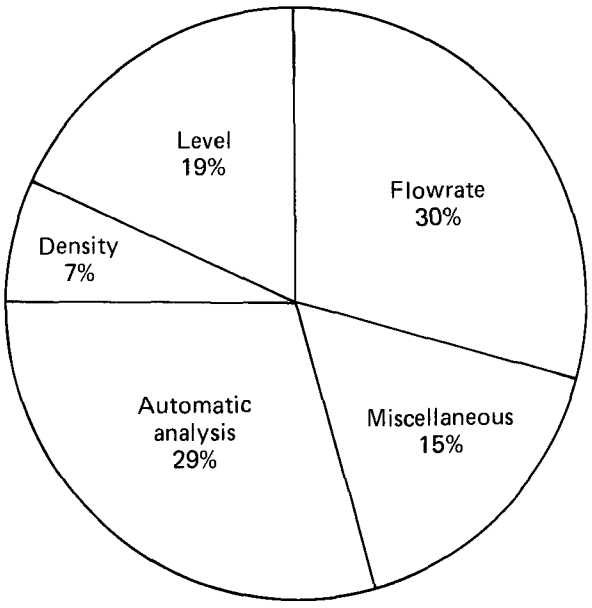


FIGURE 1. Observed distribution of process instruments in wastewater treatment plants.

sidered marginal or excessive maintenance is required), and satisfactory (see Figure 2). Except for such devices as the bubbler-type level detectors, venturis, and temperature gauges, most instruments had a performance record 31 percent less than satisfactory. The survey also found that the reported reliability of the instruments is not uniform, and instruments manufactured by the same manufacturer and of identical model were abandoned at some locations but were satisfactory at other locations. One probable cause for this anomaly is that the quality and quantity of maintenance varied at different plant sites. Control of the hydraulics and chemical dosage using analog methods were the principal control techniques observed being used by the survey teams.

The performance of the automatic control system was to a large degree determined by the performance of the measuring devices. Simple equipment such as bubbler-type level detectors performed well and were integrated successfully into automatic control systems. Except in the case of computers, as the control scheme or the sensor required became more complicated, the number of poor experiences increased. (See Figure 3.) One important finding of the survey was that approximately 31 percent of the instruments or automatic control loops were abandoned.

The most widespread process and, thus, the one receiving the most attention is activated sludge. Air supply is best controlled by using DO as the controlling parameter. If properly applied, DO control will show a cost and energy saving, and in many cases will improve the performance of the plant. Food-to-microorganism (F/M) control in general still requires further research. The details of EPA research on DO and F/M control are discussed later in this report. In general, instantaneous F/M control has no apparent advantage over DO control, with the possible exception of its application in step-feed systems, such as were demonstrated by the EPA at Hillsboro, Oregon. A related control strategy is the control of the sludge retention time (SRT), which appears to offer no difficulties and is easy to implement.

Another approach to the control of the aerator is a system that has been demonstrated by Brouzes, in France. The system wastes activated sludge on the basis of the air demand. Although the system has not been tested in the United States, it is being used in France.

Very few process control strategies are being used in sludge conditioning and dewatering because of a lack of understanding of the basic nature of the processes used. This area will be a major target for EPA research and development in the near future. Most of the controls used are to protect and control the machinery. For both the incinerator and the anaerobic digester, temperature controls are well-established technology.

Because of the similarity of the physical-chemical processes to those currently used in some parts of the chemical industry, automatic control systems are relatively easy to implement. Because of the short response times, breakpoint chlorination requires tight control. Systems for complete on-line control without some flow or load equalization have not yet been developed.

Automatic control technology for both chlorine disinfection and stormwater treatment and detention centers is well established, and control systems are usually available from the equipment manufacturer.

EPA Research

Effectiveness of Automation for Biological Treatment. The primary question that EPA research has sought to answer is how effective is automation? The technique usually suggested for such an evaluation is the comparison of plant performance under automatic control with that under manual operation. However, the standards for manual operation vary according to the idiosyncrasy of each plant and of each operator. It is necessary, therefore, that the manual operation be well defined and rigidly enforced. Two long-term studies that partially meet these requirements were carried out at Renton, Washington, and Palo Alto, California.

The Renton plant was operated for about a year (March 1970 to April 1971) under manual control while an automatic DO control system was being installed in a new aerator. The following year, the plant was operated

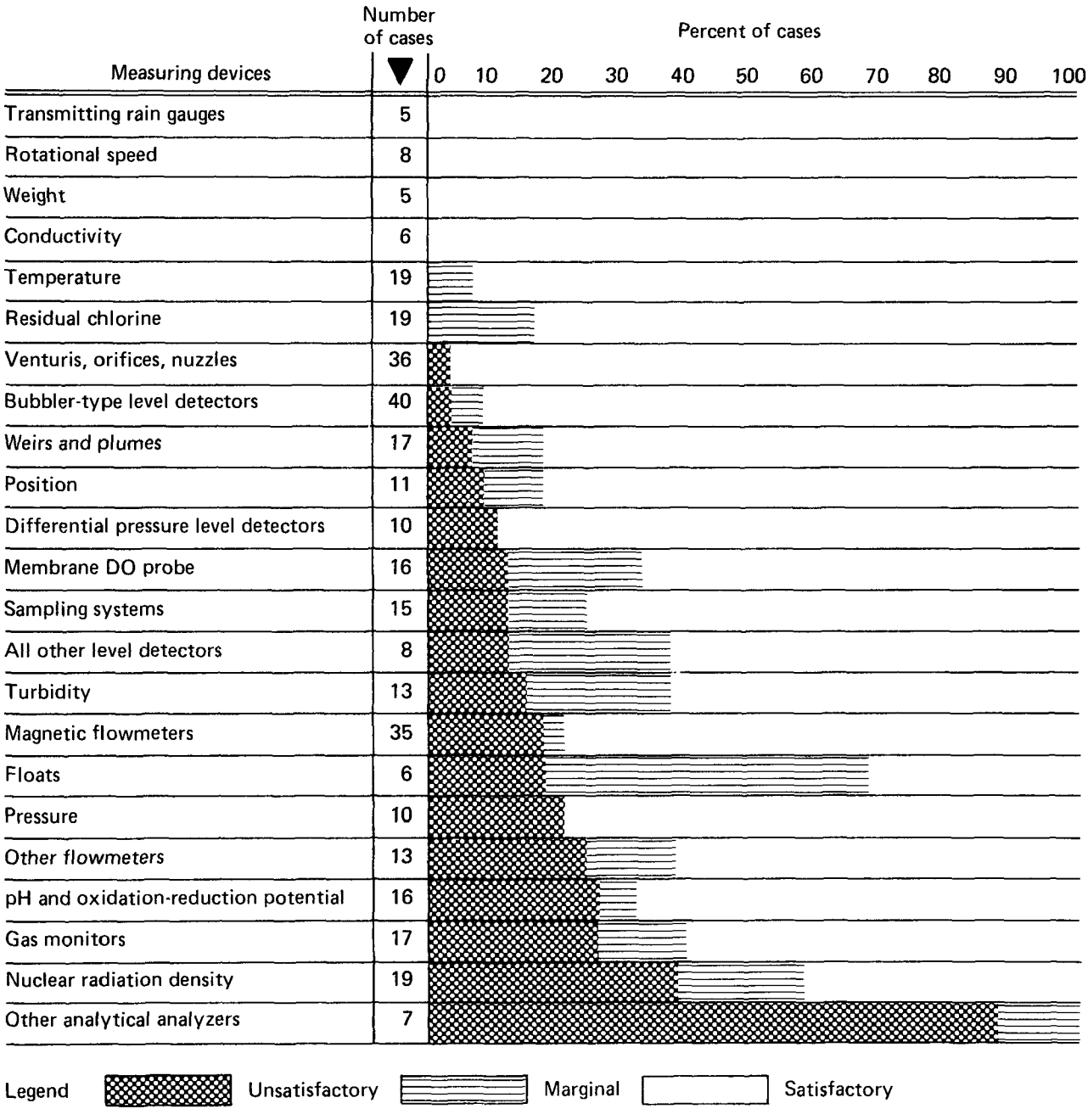


FIGURE 2. Performance summary of measuring devices in wastewater treatment facilities.

successfully with automatic DO control. Data were collected for comparative purposes during the months of October, November, and December for the years 1970 and 1971. The operators and plant management had an excellent attitude toward automation. Also, the manual control policy, which consisted of manual DO measurements and air flow adjustments twice per shift, was well defined and expertly carried out.

It is unlikely that the sewage would be identical for both time periods. In fact, the biochemical oxygen demand (BOD) loading to the plant was 50 percent higher during the period of automated operation. In spite of this increase, the performance of the plant improved. The effluent BOD decreased from a geometric mean of 11.1 ppm, obtained during manual operation, to a mean of 3.9 ppm for automatic operation. Figure 4 shows the effluent BOD data plotted on logarithmic probability paper to obtain a frequency distribution of measurements. The slope of the lines reflects the degree of reliability. For example, in Figure 4, the reduced slope of the automatic control line indicates that automation resulted in less variation of effluent BOD.

Further analysis indicated that the sludge characteristics may also have been affected by automatic DO control. The frequency distribution of the sludge volume index (SVI) is

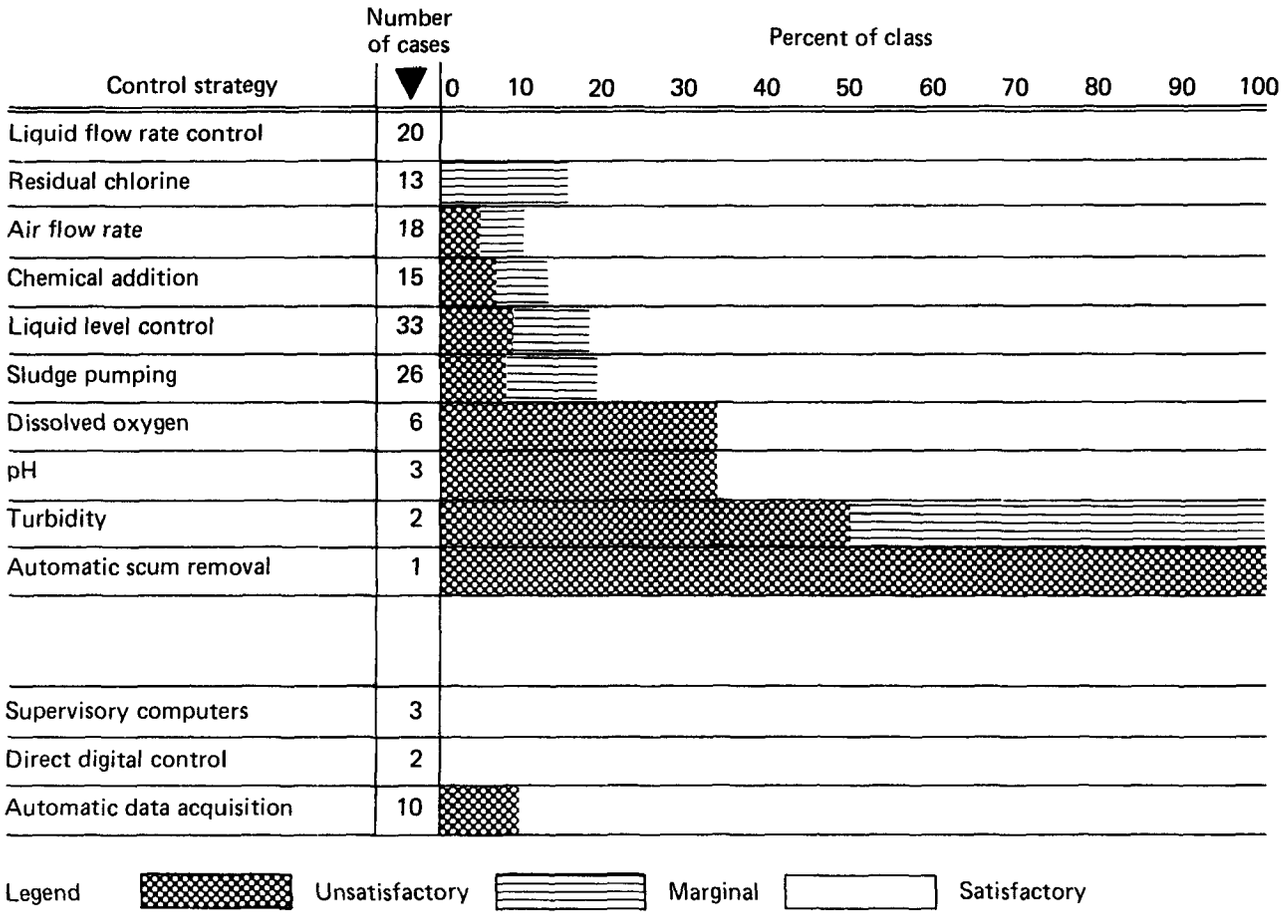


FIGURE 3. Summary of automatic control performances in wastewater treatment facilities.

shown in Figure 5. The arithmetic mean for the SVI with manual control was 332. This mean was reduced to 86 with automatic control. The difference in the slopes of the two lines is more marked than for the effluent BOD comparison, indicating a greater advantage for automatic control in maintaining an acceptable SVI.

During the semiautomatic operation at Palo Alto, the computer calculated the DO setpoints using data obtained from DO probes, and then the operators made the appropriate

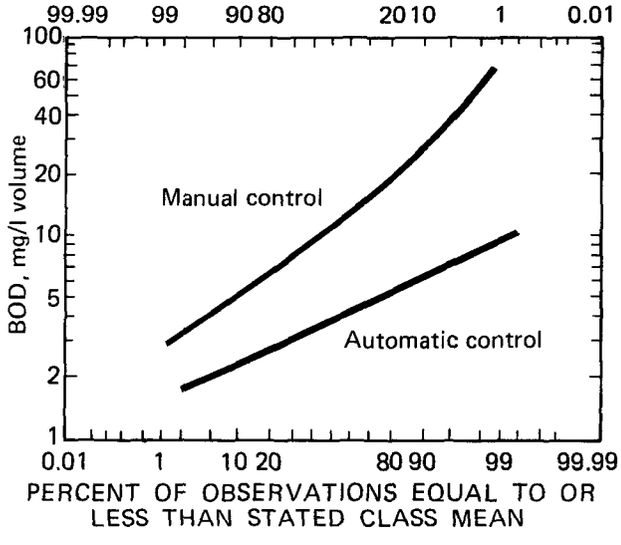


FIGURE 4. Comparison of automatic vs. manual operation using BOD in the effluent.

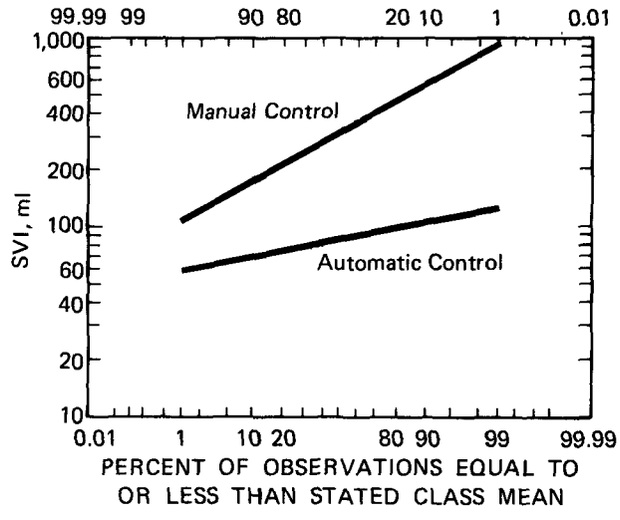


FIGURE 5. Comparison of automatic vs. manual using SVI.

corrections. Manual operation consists of manual measurements and adjustments twice per shift. When the semiautomatic operation was compared to manual operation (Figure 6), an improvement in effluent suspended solids was noted. In addition, a 13-percent performance improvement as measured by effluent total organic carbon (TOC) and an 11-percent reduction in air use was observed. The latter calculates to a saving of $5,380 per year for a 25-mgd plant, based on 1974 dollars.

The other control strategies that were evaluated at Palo Alto concentrated on F/M. Several techniques, such as TOC, chemical oxygen demand (COD), and oxygen uptake, were considered for measuring the food. However, suitable automatic TOC and COD analyzers were not available for on-line control during the Palo Alto experiments. Therefore, only two F/M control strategies could be evaluated. These were feedback respirometry FR control using an on-line respirometer, and DO return activated sludge (RAS) control. In both cases the DO was controlled as described earlier, and, because the results were similar, only the DO/RAS control loop will be described.

For DO/RAS control, the aeration tank is used as a respirometer. The rate of air demand is assumed to be proportional to the BOD input, and the return sludge is adjusted to maintain the desired F/M ratio. It was found at Palo Alto that DO/RAS and FR control are technically feasible control strategies; however, when comparing the results to those obtained when only DO control was used, the plant showed no performance improvement in terms of effluent quality or cost savings.

These results do not mean that F/M control is not desirable. A recent study at Hillsboro, Oregon, indicated that when a plant is subjected to severe shock loads F/M control will maintain effluent standards. Another factor that has not been evaluated is the effect of F/M control in maintaining, over a long period, desirable bacterial types in the activated sludge systems.

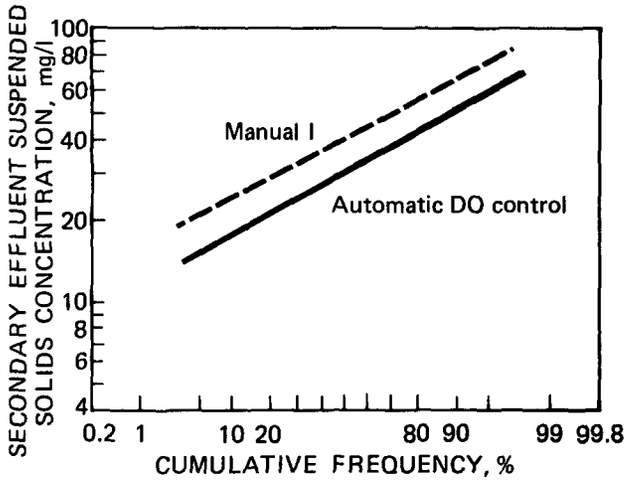


FIGURE 6. Palo Alto comparisons of automatic vs. manual for secondary effluent suspended solids.

Tests at 12 activated sludge treatment plants (including Renton and Palo Alto) showed that in 9 cases automatic DO control provided substantial savings in aeration energy usage over manual DO control. Only nine cases were considered to have had the necessary criteria for a comparison of automatic to manual operation, and of these nine cases substantial improvements in BOD removal efficiency were observed at only two plants. In the case of sludge sedimentation, four plants were observed to have significant improvements, with the remainder showing little improvement. These data are summarized in Table 1.

Table 1

SUMMARY OF AUTOMATED DO CONTROL PERFORMANCE

Parameter	Percent improvement	Number of plants
Air supplied per unit quantity of BOD removed	21.9	9
Air supplied per unit volume of influent	11.6	9
BOD removed per blower kilowatt-hour	32.1	5
BOD removal efficiency	13.8	2
Improvement in sludge volume index	108.6	4

The results do indicate that DO control is a valuable control loop that should be explored further. The ease and simplicity of installing and maintaining a DO loop is more than compensated for by the cost saving and performance improvements.

Automation of Physical-Chemical Treatment. Compared to biological treatment, the technology for physical-chemical treatment is better understood. But because of the lack of full-scale, fully automated, physical-chemical treatment plants, the EPA research was conducted at the Blue Plains pilot plant. The processes at the pilot plant consisted of lime precipitation with intermediate recarbonation, dual media filtration, breakpoint chlorination, and granular carbon adsorption.

Every process had some degree of automation, but only the four alternative control strategies for lime-feed control and filtration and the control strategies for breakpoint chlorination will be described.

The four alternative strategies studied for lime-feed control were conductivity ratio, flow proportional, pH plus flow proportional, and alkalinity plus flow proportional.

The conductivity-ratio control scheme involves measuring conductivity in the primary reaction zone and in the influent wastewater. The ratio of these measurements generates a control signal for the lime-feed valve. For flow-proportional control, the influent flow rate is measured, and this signal is transmitted directly to the control valve. For pH plus flow-proportional control, the pH is measured in the primary reaction zone, and this signal is used to adjust the signal generated from the flow-proportional loop. For alkalinity plus flow-proportional control, a sample is pumped from the clarified zone of the clarifier through a porous rock filter to an automatic titrator. The resulting alkalinity signal is transmitted to the multiplying transmitter in a flow-proportioning control system for final adjustment of lime addition.

The results of a 7-day test run are shown in Table 2.

Table 2

PERCENTAGE DEVIATION FROM TARGET DURING 7-DAY TEST RUN

Control scheme	Ranges of deviation from target alkalinity, %
Conductivity-ratio	+16 to -20
Flow-proportional	+15 to -15
pH plus flow-proportional	+10 to -10*
Proportional	+10 to -15**
Alkalinity plus flow-proportional	+7.5 to -7.5

*First 2 days.
**Entire 7-day test period.

Conductivity-ratio control was found to be the least accurate, but it would be a good backup control system because it is dependable and the equipment requires little maintenance. The flow-proportional control system was very sensitive to any change in lime-slurry concentration and depended heavily on the accuracy of the flow measurement device. After 7 days of operation, the pH electrodes were coated with a calcium carbonate scale approximately 1/16 inch thick. This coating was removed in 2 percent hydrochloric acid and the electrode regained its initial response characteristics. By scheduling electrode cleaning every 2 days, pH control will work satisfactorily. Placement of the pH probe in a separate rapid-mix tank reduces the maintenance requirements associated with placement in the primary reaction zone of a single-unit clarification system.

Although alkalinity plus flow-proportional control produced the closest alkalinity control of all the systems studied, the equipment malfunctioned repeatedly because of filter clogging. The inability to filter high solids concentrations efficiently required relocation of the sample point from the reaction zone to the clarified zone. This change resulted in a 2-hour lag in the response time, which caused large swings in process effluent quality when the lime-slurry concentration changed. Until the solids handling problem for alkalinity plus flow-proportional control is solved, the recommended control system is pH plus flow-proportional, with conductivity-ratio control as a backup.

Operation of the dual-media gravity filters was controlled with four alternative backwash initiation and control schemes. Alarm schemes used to initiate backwash had time-delay circuits to prevent accidental or momentary events from triggering the backwash cycle prematurely. The four models used were headloss, high level (influent level), programed time interval, and manual. The headloss sensor initiates the backwash cycle when the available head decreases to a preset minimum value. When the level tends to change, the high level indicator opens an effluent control valve so that a constant level is maintained. When the control valve is 100 percent open, backwash is initiated. The programed time interval controller will initiate backwash at the expiration of a preselected number of operating hours. The operator may override any of the above controls at any time with the manual mode.

The effluent from clarification was distributed equally to the operating filters by a mechanical splitter box. As a filter was isolated for backwash, the flow to that filter was redistributed to the remaining operating filters. If the headloss alarm was used and if the filter backwash occurred at peak flow rates, the redistribution caused the already stressed operating filters to be overstressed. The final result was a chain reaction resulting in the need to backwash all available filters in a relatively short time, which increased the requirements for backwash-water pumps and storage capacity.

The programed time interval controller was used to schedule filter backwashing at different hours during periods of low flow. This approach reduced backwash-water pumping and storage requirements, and it eliminated overstressing of the system. The headloss indicator was then used as a backup

alarm to prevent flooding when system upsets caused increased solids loading and shorter filter runs than the programed time interval. The high level alarm was connected to an audiovisual alarm and was used to indicate equipment failure. This system has provided peak operating efficiency at the lowest possible operating cost.

Breakpoint Chlorination

The control scheme developed to control breakpoint chlorination employs a feedforward signal proportional to the mass of influent ammonia and a feedback signal based on the free residual chlorine concentration error. The feedforward signal is derived from the concentration of ammonia in the influent, the influent flow rate, and a preselected weight ratio of chlorine to ammonia. If digital control of the system were practiced, this feedforward signal would be adjusted by the amount of chlorine used for pH control during prechlorination. The control loop for alkali addition (NaOH) is derived from a feedforward signal based on the chlorine dose used and a feedback signal based on the pH error. The on-stream analysis of ammonia by a colorimetric analyzer, both before and after breakpoint chlorination, has been accurate and dependable. Free residual chlorine is also measured continuously by a colorimetric analyzer. Preliminary operating experience has been favorable.

Digital Control

Only a few plants have used digital loops in this country as indicated in the EPA survey; most use analog control. Except at the EPA pilot plant and at Palo Alto, where digital process control systems were studied, the digital control applications have been restricted chiefly to hydraulic regulation of collection systems or of the flows at the treatment plant, and to DO control in the activated sludge process. The San Jose plant is a typical example of this direct digital operation Many plants are constructing or planning installation of digital process control systems, as for example, the planned physical-chemical plant at Garland, Texas, the Metro Plant in St. Paul, Minnesota, and the recently completed plant at Contra Costa, California. But at present the integrated digital process control approach has not been adequately developed. For large plants, control with a digital computer is the most economic technique.

Another approach to the use of the computer is demonstrated by Los Angeles County Sanitation District. Here, five wastewater treatment plants are semiautomatically controlled by a centrally located computer. The operators of each of these plants key in their data to the central computer using a terminal. The computer analyzes and stores the data and also calculates operational setpoints for the plants. This information is then teletyped to the operator who manually adjusts the plant.

Research Needs and Problem Areas

To initiate a coordinated attack on instrumentation and automation problems in this field, a workshop entitled "Research Needs for Automation of Wastewater Treatment Systems" was held in Clemson, South Carolina, in September 1974. This workshop, sponsored by EPA in cooperation with Clemson University, provided an opportunity for workers in this area to discuss their research problems and needs.

The workshop found that the general problem areas were the lack of adequate field experience, quantitative understanding of wastewater systems, and required sensors. In other words, the problems are a lack of sensors and of fundamental knowledge about the treatment processes. These problems were stated in almost every session. To resolve these problems, the needed research should include demonstrations of automated process control,development of mathematical models and algorithms, and evaluation of sensors. The workshop also indicated a need for an information clearinghouse, including the international exchange of data; and projected a new philosophy of wastewater renovation as opposed to processing wastewater to minimum quality requirements. The cost-effective application of instrumentation and automation to wastewater management systems will be a key to implementing this philosophy.

This feature article on automation of wastewater treatment was prepared by Joseph F. Roesler, Municipal Environmental Research Laboratory, U.S. EPA, Cincinnati, Ohio.

DESIGN SEMINARS FOR SMALL WATERWASTE TREATMENT SYSTEMS

Five Technology Transfer design seminars for small waterwaste treatment systems have been presented since March. These seminars were held in Seattle, Washington, March 7-9, in Philadelphia, Pennsylvania, March 30-31; in Kansas City, Missouri, April 26-28, in Concord, New Hampshire, May 4-5; and in San Francisco, California, May 24-26.

Key presentations at these seminars were given by Gordon Culp and H.H. Benjes, Clean Water Consultants; Richard Otis, William Boyle, Jerry Tyler, and James

Converse, University of Wisconsin; Joseph Rezek and Ivan Cooper, Rezek, Henry, Meisenheimer and Gende; Joseph Middlebrooks and James Reynolds, Utah State University; Jerry Troyan, Brown & Caldwell; William Bowne, Douglas County, Oregon; and James Kreissl, U.S. EPA, Cincinnati, Ohio.

Future seminars in this series will be held in Denver, Atlanta, Dallas, New York, and Chicago.

COAL MINING POLLUTION CONTROL

Over 140 mining representatives attended a 1-day seminar, "The Practical Aspects of Coal Mining Pollution Control," held in Hazard, Kentucky, on March 8, 1977. The seminar was sponsored by EPA, Hazard Community College, and the National Coal Association. The seminar provided mining operators the opportunity to meet with EPA officials from Region IV and the Cincinnati Industrial Environmental Research Laboratory.

The seminar was designed for the participants and attendees to exchange and share information on current practices for defining and controlling coal mining pollution. The topics presented included information on EPA regulations and procedures, 208 planning, sediment and erosion control, and sampling procedures. The seminar format will be repeated in Zanesville, Ohio on July 19 and 20 (see Technology Transfer Scheduled Events).

George Harlow, U.S. EPA Region IV, answers questions from the audience at the Hazard, KY, Mining Pollution Control Seminar.

Participants on the morning panel discussion at the Hazard, KY, seminar are (left to right) Asa Foster, John Martin, George Harlow, John Marlar (all of U.S. EPA) and Charles Peters of Kentucky's Department of Natural Resources and Environmental Protection.

METAL FABRICATING SEMINARS AND SEMINAR PUBLICATIONS

Over 600 industrial representatives attended four 2-day Technology Transfer seminars, "Upgrading Metal Machining, Fabricating, and Coating Operations to Reduce Pollution." The seminars, held in Boston, Chicago, Anaheim, and Dallas, attracted industrial decision makers who are responsible for selecting, purchasing, designing, or operating pollution control equipment. The seminars' technical sessions emphasized proven and available practical solutions for the control of air and water pollutants; the reduction of wasteloads; and the treatment, disposal, or recovery of waste products and heat. The seminars were sponsored by EPA, EPA, the Society of Manufacturing Engineers (SME), and the Association of Finishing Processes of SME.

The information presented in the technical sessions is available in three volumes of the seminar publication, "Controlling Pollution from the Manufacturing and Coating of Metal Products." These volumes may be obtained by checking the appropriate box (#3004) on the order form in the back of this newsletter.

Attendees hear discussions on air and water pollution control technology at the Metal Fabricating Seminar in Boston, February 22-23, 1977.

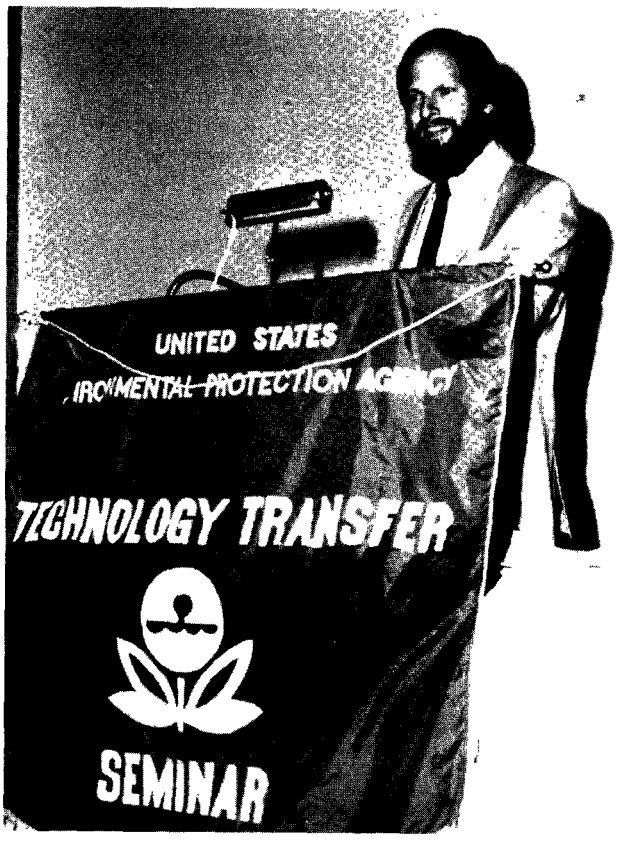
TECHNOLOGY TRANSFER SEMINARS ON POTABLE WATER TREATMENT

Technology Transfer's first regional seminars on "Designing and Upgrading Drinking Water Treatment Systems" were held on the dates and in the locations shown below in Regions VI, X, and III, respectively.

New Orleans, Louisiana	April 20-21, 1977
Portland, Oregon	May 25-26, 1977
Reston, Virginia (Washington, D.C.)	June 1-2, 1977

Attendance at the seminars, in general, exceeded 250 individuals, including representatives of consulting firms, utilities, equipment manufacturers, and state and federal regulatory personnel. Each attendee received copies of pertinent legislation, the "Manual of Treatment Techniques for Meeting the Interim Primary Drinking Water Regulations," and handouts on the "Application of Treatment Technology."

This water treatment seminar is new, is 2 days in length, and covers the following



Dr. Gary Logsdon, U.S. EPA, MERL, addressing the New Orleans Water Treatment Seminar.

R. Rhodes Trussell, of J. M. Montgomery Consulting Engineers, spoke about the application of treatment technology at the Technology Transfer Water Treatment Seminar in New Orleans.

areas: The Safe Drinking Water Act, chemical treatment, ion exchange and reverse osmosis, filtration, organics in drinking water, trihalomethanes and general organics control, and the application of treatment technology.

Key presentations were made by Dr. Joseph A. Cotruuo and Thomas Hushower, of U.S. EPA, Washington, D.C.; Dr. J. Edward Singley of Water and Air Research, Inc., Gainesville, Florida; Dr. Rhodes Trussel of J.M. Montgomery Engineers, Pasadena, California; Joseph L. Rizzo and Ken Janecek of Calgon Corporation in Pittsburgh, Pennsylvania; and Drs. Gary S. Logsdon and Thomas Love of Municipal Environmental Research Laboratory, Cincinnati, Ohio.

Future seminars on water treatment are planned, and detailed information on these can be obtained from the appropriate Technology Transfer regional chairman listed in the back of this newsletter or by calling the Environmental Research Information Center at (513) 684-7394.

EIGHTH NATIONAL FOOD WASTE SYMPOSIUM

The eighth EPA National Symposium on Food Processing Wastes was held in Seattle, Washington, March 30-April 1, 1977. The 250 attendees received information on Technology Transfer activities, EPA guidelines, and pollution control demonstrations conducted during the past year. This annual symposium series is cosponsored by several food processing associations, including the Food Processors Institute, the National Canners Association, and the Northwest Food Processors Association.

Jim Boydston (standing) opens up the eighth National Food Waste symposium in Seattle, March 30-April 1, 1977. Seated left to right on the speaker's stand are Jeff Denit and Guy Nelson of U.S. EPA.

HANDBOOK "ANALYTICAL QUALITY CONTROL IN WATER AND WASTEWATER LABORATORIES" BEING UPDATED

The EPA Environmental Monitoring and Support Laboratory is updating the Technology Transfer handbook entitled "Analytical Quality Control in Water and Wastewater Laboratories." Five new chapters are being added to the 1972 edition, and copies should be ready for distribution in early 1978.

MANAGEMENT SEMINAR PUBLICATION

A new seminar publication, "Choosing Optimum Management Strategies," is available. The publication delineates the options to be considered in making and carrying out a capital expenditure decision on an investment in pollution control equipment. Some of the options discussed cover topics such as interpreting laws and regulations, dealing with consultants and attorneys, and interacting with regulatory agencies. Also, the important aspects of buying and installing the needed equipment are presented. These aspects include management timing, Turnkey vs. Company Integration, design development procurement package formation, bid evaluation, and acceptance testing.

This publication is designed to complement an already well accepted publication, "Choosing Optimum Financial Strategies." Both publications are directed to personnel who have some supervisory, management, or financial responsibilities for interest in plant pollution control measures. These publications can be obtained by checking the appropriate boxes (#3005 for Financial and #3008 for Management) on the order form in the back of this newsletter.

FOREST PRODUCTS SEMINAR

A seminar will be held in Dallas, Texas, on September 28 and 29, 1977, to provide a comprehensive review of environmental topics in the primary wood products industry. Heavy emphasis will be placed on silviculture and forest management techniques as well as case histories of specific processes and operations. The papers will be directed toward engineers and environmental managers in the forest products industry, state and local agencies, and consulting firms.

The Forest Products Research Society and tion (FGD) facility. The FGD demonstration jointly developing the seminar. Future seminars may be held in EPA Regions I and X. If interested in attending the seminar, contact the ERIC staff in Cincinnati for more information.

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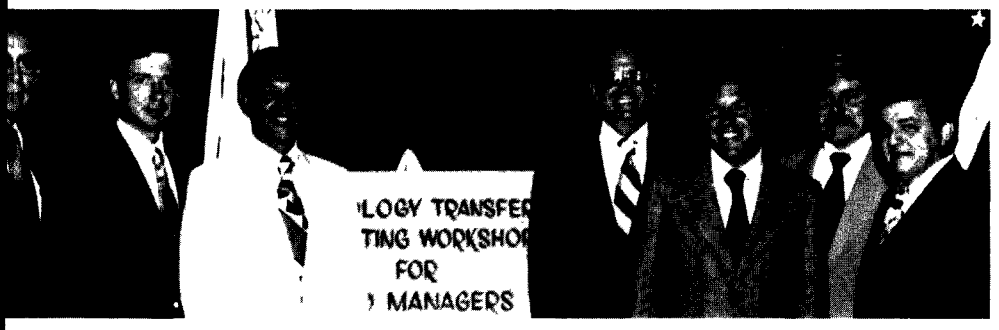
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"UPGRADING EXISTING WASTEWATER TREATMENT PLANTS" SEMINAR HANDOUT REVISED

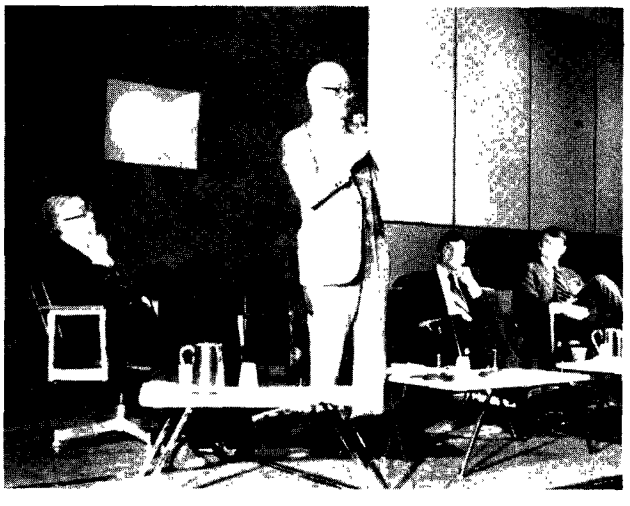
The Technology Transfer seminar publication entitled "Upgrading Existing Wastewater Treatment Plants," originally published in August 1973, has been revised and is available upon request. This revision includes five new case histories on wastewater treatment plant upgrading: Stockton, Sacramento, Palo Alto, and San Jose-Santa Clara, in California, and Renton, Washington. Two of the four case histories included in the original version have been deleted.

This publication was revised by Warren Uhte and Richard Stenquist of Brown and Caldwell. The original version was prepared by David Walrath of Hazen and Sawyer.

This revised publication can be obtained by checking the appropriate box (#4005) on the order form in the back of this newsletter.

INDUSTRIAL INITIATIVES CONFERENCE

A unique conference series, "Industry Takes the Initiative," was started with a kick-off conference in Chicago, Illinois, January 17-18, 1977. High ranking congressional, corporate, and federal/state officials participated in it. The first day provided the 380 decision makers and policy planners attending with information regarding process changes to reduce pollution and save money. The second day addressed specific technical achievements that companies have made in this area. In addition to EPA, the cosponsors of the conference were the Department of Commerce, the state chambers of commerce, and manufacturing associations in Illinois, Indiana, Michigan, Minnesota, Wisconsin, and Ohio. Also included were the following corporations: Commonwealth Edison, Eli Lilly, Hydroscience, Republic Steel Corporation, Dow Chemical, 3M Corporation, and St. Regis Paper Company. Conference highlights were presentations by Russel Train and Elliot Richardson. As part of the continuing series, future conferences are planned in Boston and Dallas (see Technology Transfer Scheduled Events).



Gladwin Hill (standing), New York Times National Environmental Correspondent, beginning the first panel discussion at the Chicago Industrial Initiatives Conference. Panelists seated left to right are Joe Ling (3M Corporation), representative James Florio (D-NJ), and Paul Brands (U.S. EPA).

TECHNOLOGY TRANSFER HOLDS MUNICIPAL DESIGN SEMINARS ON SLUDGE TREATMENT AND DISPOSAL

Three Technology Transfer design seminars on sludge treatment and disposal have been held thus far in 1977.

The first in this seminar series was held in Newark, New Jersey, April 13-14, and was attended by approximately 250 professionals.

The next sludge seminar was held in Salt Lake City, Utah, May 2-3, and attracted 200 interested participants from the region.

The third seminar was held in Atlanta, Georgia, May 11-12, with attendance in excess of 250 interested participants concerned with pollution control and abatement.

Bruce Weddle (U.S. EPA, OSWMP) addresses the audience at the Newark Sludge seminar.

The fourth sludge seminar will be held September 13-14, 1977, in Boston, Massachusetts. This schedule is a change from the dates given in previous announcements.

Each seminar featured sessions on "Innovative Sludge Processing Technology," dealing with lime stabilization and dewatering processes that produce high-solids sludge cakes; "Conversion and Product Recovery Systems," which discussed composting, utilization of gas from anaerobic digestion, and coincineration or copyrolysis of sludge and solid wastes; and "Land Application of Sludge for Agricultural Use," dealing with this subject quite extensively in two 3-4-hour discussion sessions.

The list of speakers at each of the seminars includes: Richard Noland and Jim Edwards, Burgess and Niple Engineers; Jack Harrison, Consultant; Dave Sussman, U.S. EPA, Office of Solid Waste Management Programs (OSWMP); Mack Wesner, Culp/Wesner/Culp; Ron Sieger, Brown and Caldwell; Bob Landreth, U.S. EPA, Municipal Environmental Research Laboratory (MERL); Bruce Weddle, U.S. EPA, OSWMP;Ken Dotson and Dr. Jim Ryan, U.S. EPA, MERL; Dr. Lee Sommers, Consulting Agronomist; and Dr. Ron Lofy, SCS Engineers.

Information concerning this seminar series can be obtained by contacting your Technology Transfer regional chairman listed in the back of this newsletter, or by contacting Dr. James E. Smith, Jr., of ERIC-Technology Transfer at (513) 684-7394 in Cincinnati, OH.

Dr. Lee Sommers, Consulting Agronomist, discussing Land Application, Rates and Techniques at the Newark seminar.

PREPARATION OF FUELS AND FEEDSTOCKS WORKSHOP

U.S. EPA's Technology Transfer and Municipal Environmental Research Laboratory (MERL) sponsored a Workshop on the Preparation of Fuels and Feedstocks for Wastes-as-Fuel, February 8-10, 1977, in New Orleans, Louisiana. The workshop, projected to be the first of a series, had about 50 participants, representing expertise in resource recovery from the Office of Research and Development and the Office of Solid Waste (OSW), U.S. EPA; the Bureau of Mines; the Energy Research and Development Administration; the military; the Ministry of Environment, Ontario; municipal engineers; research organizations; architect/engineers; and private firms engaged in resource recovery.

The workshop had an open format, allowing for free interchange of ideas among workshop members. There were five sessions, each with a moderator. John Burckle, MERL, convened the Workshop.

The final morning of the Workshop was devoted to a visit to Recovery I, a resource recovery facility being developed by NCRR, the City of New Orleans, and Waste Management, Inc.

Session 1 dealt with system process design, with Dr. Albert J. Klee, MERL, as moderator. A strong theme of the session was the lack of information available to system designers, and the need for more research. Workshop members expressed a desire for more communication between manufacturers and users of systems. Materials handling, scale-up, and fuel specifications were discussed.

The topic of Session 2 was selection of equipment. Four areas were discussed: materials handling, size reduction, separation, and process control. Stephan Lingle, OSW, moderated.

Dr. Harvey Alter, National Center for Resource Recovery (NCRR), conducted Session 3 on technical obstacles. Again the need for more information was stressed. An interesting feature of the session came when members voted on their preferences for high

priority and low priority research needs. The results will be published in the Proceedings.

Session 4, moderated by John Burckle, dealt with approaches to research, development, and demonstration programs. Scale-up and sampling were primary concerns. Several speakers then summarized their pilot plant operations, including Dr. Alter; Roger DeCesare, Bureau of Mines; Dr. George Trezak, University of California; Steve Hurley, U.S. Navy; and G. C. Chisamore, Ontario.

David Berg, Office of Energy, Minerals, and Industry (OEMI), summarized the Workshop in Session 5. He noted the lack of data impeding near-term implementation and long-term development.

EPA HOLDS NATIONAL CONFERENCE ON LESS COSTLY WASTEWATER TREATMENT SYSTEMS FOR SMALL COMMUNITIES

A national conference aimed at disseminating information on less costly wastewater treatment systems for small communities was held on April 12-14, 1977, in Reston, Virginia. This EPA conference was cosponsored by Technology Transfer, the Office of Water Program Operations, and the Municipal Environment Research Laboratory.

Sound and economical alternatives to conventional centralized wastewater collection and treatment systems for small communities were the focus of this 2½-day conference. State-of-the-art case histories were presented for the provision, operation, and maintenance of adequate and economical wastewater treatment facilities for small communities.

Discussions included present government policy on wastewater facilities, and descriptions of major types of conveyance and treatment systems and their comparative costs. Examples were provided of successful and cost-effective installations that meet environmental requirements. Alternative organizations for maintaining and operating small facilities were also discussed.

The Honorable Jennings Randolph, Chairman, Senate Committee on Environment and Public Works, was the conference's keynote speaker. Douglas M. Costle, newly appointed EPA Administrator, welcomed the assembled municipal officials, state health and water pollution officials, consulting engineers, educators in sanitary and environmental engineering, and representatives from environmental and public interest groups. Other speakers included Marilyn Klein, Council on Environmental Quality, and John Rhett, EPA Deputy Assistant Administrator for Water Program Operations.

Proceedings from this conference will be published in the near future. Announcement of proceedings availability will be made in this newsletter.

Lawrence Waldorf addresses the audience at the National Small Flows Conference in Reston, Virginia.

The Honorable Jennings Randolph.

WELLMAN-LORD FLUE GAS DESULFURIZATION CAPSULE REPORT AVAILABLE

This capsule report describes initial results from a joint program being conducted by Northern Indiana Public Service Company (NIPSCO) and EPA to demonstrate the sulfur dioxide removal capabilities of the Wellman-Lord/Allied Chemical flue gas desulfurization (F6D) facility. The FGD demonstration plant is retrofitted to the Unit No. 11 coal-fired boiler at NIPSCO's Dean H. Mitchell Station in Gary, Indiana. The FGD plant consists of the Davy Powergas Inc. proprietary design Wellman-Lord SO_2 Recovery Process,

Davy's Purge Treatment Unit, together with Allied Chemical Corporation's SO_2 reduction process.

This capsule report summarizes the operational progress on the Wellman-Lord SO_2 Recovery portion of the FGD facility. After the Acceptance Test has been performed, another capsule report will summarize the final results of the program.

The Wellman-Lord process is a regeneration process where a sodium sulfite solution absorbs and chemically reacts with the sulfur dioxide to form sodium sulfite, sodium bisulfite, and sodium sulfate. Sulfur dioxide is separated from the solution and reacted with natural gas to form elemental sulfur. The spent solution is treated and returned to the feed system.

The report has been jointly prepared by the Environmental Research Information Center and the Industrial Environmental Research Laboratory (IERL). For further information on the Wellman-Lord and other FGD programs, contact the IERL facility in Research Triangle Park, North Carolina, (919) 549-8411.

"UPGRADING LAGOONS" SEMINAR HANDOUT REVISED

The Technology Transfer seminar publication entitled "Upgrading Lagoons," originally published in August 1973, has been revised and is available upon request. This revision includes two new case histories on upgrading lagoons: the Antelope Valley Tertiary Treatment Plant in Lancaster, California, and the Richfield Springs, New York, Treatment Plant. One of the three case histories included in the original version has been deleted and the other two have been updated.

This publication was revised by Brown and Caldwell Consulting Engineers, Walnut Creek, California. Brown and Caldwell also prepared the original version.

This revised publication can be obtained by checking the appropriate box (#4001) on the order form in the back of this newsletter.

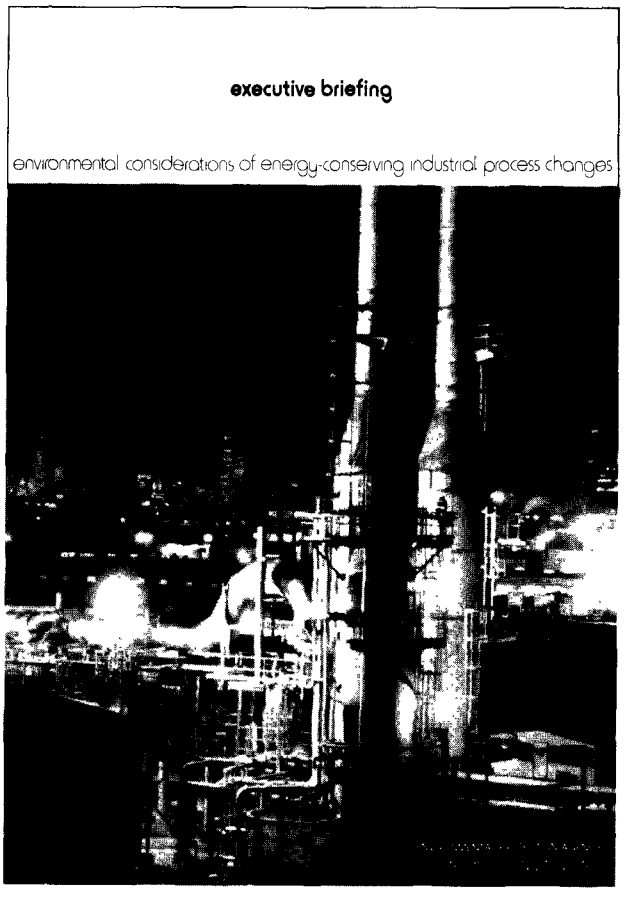
FRUIT AND VEGETABLE PROCESSING SEMINAR PUBLICATIONS

A new seminar publication, "Pollution Abatement in the Fruit and Vegetable Processing Industry," is available in three volumes. The publications cover the technical information presented at the five fruit and vegetable processing seminars held across the country in 1976. The topics covered include basics of pollution control, case histories, in-plant process changes, and wastewater treatment. The Food Processors Institute, National Canners Association, and CH2M-Hill assisted in its preparation. The seminar publication can be obtained by checking the appropriate box (#3007) on the order form in the back of this newsletter.

NEW TECHNOLOGY TRANSFER PUBLICATION SERIES: EXECUTIVE BRIEFING

The first publication in a new Technology Transfer series designed for high level industrial decision makers is now available for distribution. The purpose of this new series (executive briefings) is to highlight important environmental research activities, including broad environmental assessments, pollution control technology demonstrations, and other important environmental considerations.

The first executive briefing, "Industrial Energy Conservation Measures," outlines the environmental impacts of current and proposed practices by industry to conserve energy. This publication can be obtained by checking the appropriate box (#9001) on the order form in the back of this newsletter.



Industrial Energy Conservation

Executive Briefing

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
CINCINNATI, OHIO 45268

June 1977

Dear Reader:

First of all I would like to congratulate each of you for your continued interest in environmental pollution control and at the same time thank you for your constant support and interest in the Environmental Research Information Center's (ERIC) Technology Transfer Program.

Since the early days of the Environmental Protection Agency, Technology Transfer has made every attempt to bridge the information gap between you, the technology user, and research development, by disseminating the most up-to-date information on pollution control technologies through pulication distribution and conducting seminars and workshops.

Most recently Technology Transfer has combined efforts and resources with the Technical Information Staff to form the Environmental Research Information Center. This organization of personnel and information will enhance the transfer of technology and information from every facet of environmental research and development.

Looking over this issue of the Technology Transfer Fact Sheet and even the last one you may have noticed some changes and additions. Perhaps the most pertinent being the addition of a complete listing of Technology Transfer's Scheduled Events for the near future. It is our hope that this will help you plan ahead and enable you to participate in Technology Transfer's seminar series whenever possible.

Lately the requests for Technology Transfer publications has been overwhelming. Many of the publications being requested are currently out of stock and are in the process of being reprinted. All publications listed on the order form in the back of this newsletter are currently in print and can be ordered by marking the appropriate boxes. Your orders will be filled and forwarded to you as soon as possible.

Sincerely yours,

Robert E. Crowe

Robert E. Crowe, Director, ERIC

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 your EPA Regional Technology Transfer Committee Chairman from the list below:

REGION	CHAIRMAN	ADDRESS
I	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.)
II	Robert Olson	Environmental Protection Agency 26 Federal Plaza New York, New York 10007 212 264-1867 (N.Y., N.J., P.R., V.I.)
III	Albert Montague	Environmental Protection Agency 6th & Walnut Streets Philadelphia, Pennsylvania 19106 215 597-9856 (Pa., W. Va., Md., Del., D.C., Va.)
IV	Asa B. Foster, Jr.	Environmental Protection Agency 345 Courtland Street, N.E. Atlanta, Georgia 30308 404 881-3454 (N.C., S.C., Ky., Tenn., Ga., Ala., Miss., Fla.)
V	Clifford Risley	Environmental Protection Agency 230 S. Dearborn Street Chicago, Illinois 60604 312 353-2200 (Mich., Wis., Minn., Ill., Ind., Ohio)
VI	Mildred Smith	Environmental Protection Agency 1201 Elm Street First International Building Dallas, Texas 75270 214- 749-3971 (Texas, Okla., Ark., La., N. Mex.)
VII	John Coakley	Environmental Protection Agency 1735 Baltimore Avenue Kansas City, Missouri 64108 816 374-5971 (Kansas, Nebr., Iowa, Mo.)
VIII	Elmer Chenault	Environmental Protection Agency 1860 Lincoln Street Denver, Colorado 80203 303 837-4343 (Colo., Mont., Wyo., Utah, N.D. S.D.)
IX	William Bishop	Environmental Protection Agency 100 California Street San Francisco, Calif. 94111 415 556-6925 (Calif., Ariz., Nev., Hawaii)
X	John Osborn	Environmental Protection Agency 1200 6th Avenue Seattle, Washington 98101 206 442-1296 (Wash., Ore., Idaho, Alaska)

For the following audio-visual material, please contact your Regional Transfer Chairman. (See above)

MOTION PICTURES (16mm sound)

- Richardson, Texas Project—Title: "Somebody around here must be doing something good." (15 min.)
- Phosphorus Removal (5 min.)
- Water Quality Management, Alameda Creek, Calif.—Title: "The Water Plan." (28½ min.)
- The Seattle METRO Story. (28 min.)
- "Breakthrough at Clear Lake" (28 min.)

ENVIRONMENTAL RESEARCH INFORMATION CENTER

ERIC
(Robert Crowe)
(Cal Lawrence)

U.S. EPA - OR & D
ERIC
26 West St. Clair
Cincinnati, Ohio 45268
(513) 684-7391 -7398 (Inc.)

ENVIRONMENTAL ASSESSMENT STAFF (Orville Macomber) (Ed Tabri) (Doug Williams)	ENVIRONMENTAL CONTROL SYSTEMS STAFF (Jim Smith) (Denis Lussier) (Guy Nelson) (Norm Kulujian)	TECHNICAL INFORMATION OPERATIONS STAFF (Gilbert Gigliotti)
LAND USE MANAGEMENT 208 Land Use Planning Non-point Sources	*MUNICIPAL* Wastewater Potable Water Supply	Research Reports Production Special Research Reports Technology Transfer Production Newsletter Production Report Distribution and Coordination Conference and Symposia Coordination Requests Coordination Mailing Lists Coordination Graphic Arts and Visual Aid Support
MONITORING, MEASUREMENT AND QUALITY ASSURANCE Monitoring Analytical Methods Quality Control Remote Sensing	*INDUSTRIAL* Wastewater Air Toxic and Hazardous Materials Energy Aspects	
HEALTH AND ECOLOGICAL EFFECTS		

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 the previous section of this newsletter.

SUBJECT	DATE	REGION/CITY	
Scheduled Municipal Seminars			
Small Wastewater Treatment Systems	July 12-14, 1977	VIII	Denver, CO
Small Wastewater Treatment Systems	July 27-29, 1977	IV	Atlanta, GA
Small Wastewater Treatment Systems	August 1977	V	Chicago, IL
Small Wastewater Treatment Systems	August 1977	VI	Dallas, TX
Small Wastewater Treatment Systems	September 1977	II	Syracuse, NY
Sludge Treatment and Disposal	September 12-14, 1977	I	Boston, MA
Tentative Municipal Seminars			
Water Treatment	October 26-27	I	Boston, MA
Scheduled Industrial Seminars			
Coal Mining	July 19, 20, 1977	V	Zanesville, OH
Wood Products	September 28, 29, 1977	VI	Dallas, TX
Industrial Initiatives	September 7, 8, 1977	VI	Dallas, TX
Tentative Industrial Seminars			
Coal Mining	Summer 1977	V	Indianapolis, IN
Remote Sensing	Summer 1977	IX	Las Vegas, NV
Metal Fabricating	Fall 1977	V	Chicago, IL
Pretreatment	Fall 1977	IV	Atlanta, GA

ENVIRONMENTAL RESEARCH INFORMATION CENTER
TECHNOLOGY TRANSFER
PUBLICATIONS

REQUEST FOR TECHNOLOGY TRANSFER MATERIAL

The publications listed on this form are the only ones available through the Office of Technology Transfer.

Please send me the following publications at no charge. (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 ☐

TECHNICAL CAPSULE REPORTS

- Recycling Zinc in Viscose Rayon Plants .....2001 ☐
- Color Removal from Kraft Pulping Effluent by Lime Addition .....2002 ☐
- Pollution Abatement in a Copper Wire Mill .....2003 ☐
- First Interim Report on EPA Alkali SO_2 Scrubbing Test Facility .....2004 ☐
- Dry Caustic Peeling of Peaches .....2005 ☐
- Pollution Abatement in a Brewing Facility .....2006 ☐
- SO_2 Scrubbing and Sulfuric Acid Production Via Magnesia Scrubbing .....2007 ☐
- Second Interim Report on EPA Alkali Scrubbing Test Facility .....2008 ☐
- Magnesium Carbonate Process for Water Treatment .....2009 ☐
- •Third Interim Report on EPA Alkali Scrubbing Test Facility .....2010 ☐
- •First Progress Report Wellman-Lord Flue Gas Desulfurization .....2011 ☐

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 Investments .....3005 ☐
- Erosion and Sediment Control from Surface Mining (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 (2 Vols.) .....3009 ☐

MUNICIPAL SEMINAR PUBLICATIONS

- Upgrading Lagoons .....4001 ☐
- Physical-Chemical Treatment .....4002 ☐
- Nitrification/Denitrification .....4004 ☐
- Upgrading Existing Wastewater Treatment Facilities—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 ☐

BROCHURES

- Logging Roads and Water Quality .....5011 ☐
- Municipal Wastewater Alternatives .....5012 ☐
- Forest Harvesting and Water Quality .....5013 ☐

HANDBOOKS

- Analytical Quality Control in Water and Wastewater Laboratories (1972) .....6001 ☐
- Monitoring Industrial Wastewater (1973) .....6002 ☐
- Methods for Chemical Analysis of Water and Wastes (1974) .....6003 ☐

INDUSTRIAL ENVIRONMENTAL POLLUTION CONTROL MANUALS

- Pulp and Paper Industry – Part I/Air .....7001 ☐

EXECUTIVE BRIEFINGS

- •Industrial Energy Conservation Measures .....9001 ☐

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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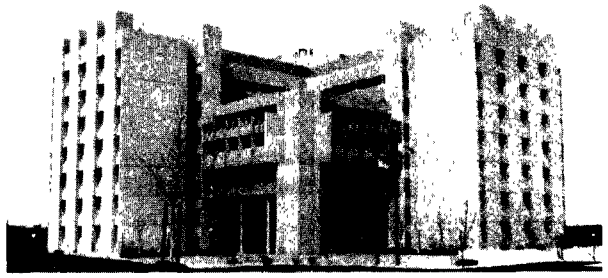
TECHNOLOGY TRANSFER RELOCATES TO PERMANENT OFFICES

EPA Technology Transfer Program has relocated to new office space in the Environmental Research Center Bldg., Cincinnati, Ohio. This move does not involve a change in the mailing address for Technology Transfer, but telephone numbers for Technology Transfer's staff have changed as follows:



U.S. Environmental Protection Agency - Environmental Research Center, 26 W. St. Clair Street, Cincinnati, Ohio 45268

• Director, Technology Transfer	—	Robert E. Crowe 513-684-7391
• Municipal Technology Transfer	—	James E. Smith 513-684-7394
• Industrial Technology Transfer (Water)	—	Guy R. Nelson 513-684-7395
• Industrial Technology Transfer (Air)	—	Norm Kulujian 513-684-7396
• Land Use Planning • Non Point Source • Analytical Quality Control	—	Orville Macomber 513-684-7397

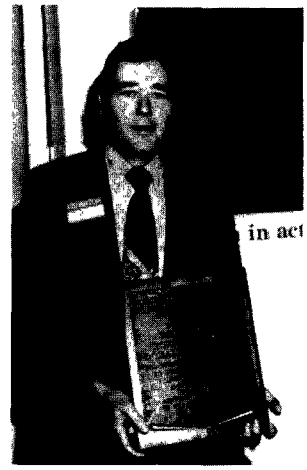
WPCF CONFERENCE

The new Technology Transfer document "Environmental Pollution Control Alternatives: Municipal Wastewater" was featured at Technology Transfer's exhibit area at the 1976 Water Pollution Control Federation Conference held October 3-8, 1976 in Minneapolis, Minnesota. This year's WPCF meeting had a total registration of over 8,600 and approximately 5,000 copies of the new Municipal Wastewater Alternatives publication were distributed at no charge. A copy of this publication (#5012) can be ordered by using the request sheet at the back of this newsletter. A highlight at the Technology Transfer exhibit was the visit of EPA Deputy Administrator, Mr. John Quarles, following his participation in one of the technical sessions.

Shown at the WPCF Conference are: (l to r) Lester. Edelman, Counsel, Water Resources Subcommittee, House Public Works Committee; Bob Crowe, Director, Technology Transfer; John Quarles, Deputy Administrator, U.S. EPA.

NCA/BCR CONFERENCE

The Industrial Environmental Research Laboratory's Resource Extraction and Handling Division (REHD) and Technology Transfer participated in the NCA/BCR Coal Conference, held October 19-21, 1976 at the Kentucky Exposition Center in Louisville. This conference addressed the emerging era of coal dominance as an energy resource, including the responsibility of upgrading coal extraction and usage both environmentally and economically. At the conference Exhibit Hall, REHD and Technology Transfer jointly provided the newest industrial



R. B. Scott received the S. A. Braley Award at the NCA/BCR Conference.

seminar publication "Erosion and Sediment Control/Surface Mining in The Eastern U.S." The 3,000 conference attendees watched as R.B. (Bob) Scott received the S. A. Braley Award for his outstanding research work in acid mine drainage. Bob is head of the EPA's acid mine drainage field station in Crown, West Virginia. The Braley award speaks highly for Bob Scott's achievements, because only five others have been recipients of the award since its inception in 1966.

Carl E. Bagge (l), President of the National Coal Association, and Otes Bennett, Jr., President of The North American Coal Corporation, stopped by the EPA Exhibit at the NCA/BCR Conference in Louisville.

THIRD NATIONAL CONFERENCE ON INDIVIDUAL ONSITE WASTEWATER SYSTEMS

The Third National Conference on Individual Onsite Wastewater Systems, co-sponsored by Technology Transfer and the National Sanitation Foundation, was held November 16-18, 1976 in Ann Arbor, Michigan. Mr. Jerome H. Svore, EPA Region VII Administrator, chaired the opening session, which included a keynote address by the chief of staff to the Honorable Jennings Randolph, Chairman of the Senate Public Works Committee. Topics covered in the technical sessions included Treatment Systems Required for Surface Discharge of Onsite Wastewater; Septage Disposal in Wastewater Treatment Facilities; Management Guidelines for Conventional and Alternative Onsite Systems; and Onsite Wastewater Facilities for Small Communities and Subdivisions. Conference proceedings will be available shortly; contact Dr. N. McClelland, National Sanitation Foundation, NSF Building, Ann Arbor, Michigan 48105 for information on obtaining the proceedings.

PLANNING ALTERNATIVES FOR MUNICIPAL WATER SYSTEMS

A conference on "Planning Alternatives for Municipal Water Systems," co-sponsored by Holcomb Research Institute of Butler University and Technology Transfer was held in French Lick, Indiana on October 10-14. Approximately 100 individuals from a wide spectrum of backgrounds participated in the conference. Among these were representatives from the President's Council on Environmental Quality, Environmental Protection Agency, officials from several major cities, and administrators and planners from water utilities both large and small. Topics discussed included Planning for Regional Urban Water Quality; Technical Feasibility of Achieving Water Quality Standards; Potable Water Reuse Planning — U. S. Experience; and Environmental Considerations in Water Quality.

Key speakers at the conference were Martin Lang, New York City Parks Department; Steve Hanke, Environmental Engineering, Johns Hopkins University; Leroy Reuter, Lt. Col. MCS, U. S. Army Biomedical Research and Development Laboratory; Francis T. Mayo, Director, Municipal Environmental Research Laboratory, U. S. EPA; and Daniel Okun, Environmental Engineering, University of North Carolina.

TRACE METAL REMOVAL BY WASTEWATER TREATMENT

Introduction

Metals are a natural part of the earth's crust; they can be found in measurable quantities in practically every living and inanimate substance in the world. Metals constitute about 5 percent of the earth's rocks and are sufficiently soluble to have been distributed, over the millennia, into every part of the environment. Because of this

ubiquitous distribution, all living things have acquired (by evolution) a tolerance for metals body burden. Indeed, all living things require certain metals for their well-being. Unfortunately, the borderline between a natural tolerance level for a metal in a species and a hazardous level may not be very wide. A typical biological response curve would show an increasingly beneficial effect with increasing concentrations up to a certain optimum level. Beyond this level, there is a tolerance region beyond which benefits decrease, injurious effects begin, and, finally, a lethal dose is reached. Certain metals (mercury and cadmium for example) serve no useful physiological function and become toxic to the organism at low concentrations.

Man's activities have upset the natural distribution of metals in the environment, and this fact alone is the basis of concern. The increase in the use of metals of all kinds has averaged about 50 percent during the 20 years from 1948 to 1968. The burning of fuel for energy disperses enormous quantities of metals into the environment.

The goal of wastewater treatment, therefore, is not to reduce trace metals to zero but rather to reduce concentrations to ambient levels and to dispose of the concentrates (sludges) such that redispersion does not recur. The objectives of this discussion are to show that metals are, in fact, present in wastewater, that current biological treatment processes are only partially effective in removing most metals, and, finally, that processes are available to obtain even greater removals. Discussion will be limited to six or seven of the more important metals.

Trace Metals in Wastewater

There have been several surveys of metals concentration in influent wastewater. The results of a recent survey of some 100 plants in Connecticut, New York, and New Jersey are shown in Table 1. The median values show that concentrations of the 7 metals are low, ranging from 0.0013 mg/1 for mercury to < 0.20 mg/1 for lead. Five percent of the samples had metal concentrations some 2-9 times higher in concentration.

Table 1

MULTIPLANT INFLUENT METALS SURVEY (CONNECTICUT – NEW YORK – NEW JERSEY)[1]

Metal	Median mg/1	Exceeded by highest 5% mg/1
Cadmium	<0.02	0.04
Chromium	<0.05	0.45
Copper	0.10	0.85
Mercury	0.0013	0.0088
Nickel	<0.10	0.50
Lead	<0.20	0.20
Zinc	0.18	1.14

[1] Based on 100-400 analyses for each metal.

The concentrations of metals that one can find in any survey can range over several orders of magnitude as illustrated in Table 2, largely due to industrial discharges. Cadmium concentrations ranged from < 0.008 mg/1 to as much as 0.142 mg/1 and zinc from as little as 0.03 mg/1 to as much as 8.31 mg/1. Comparison with recommended drinking water standards shows that in most cases the concentration of metals in influent wastewater is less than drinking water requirements, although clearly the higher concentrations exceed the drinking water standards. The comparison is made only to provide a point of reference. Comparison is also made with quality criteria for aquatic life to indicate the very much lower concentrations required for some of the metals. The plant effluent concentration to protect aquatic life will, of course, depend on the dilution available at the point of discharge.

Table 2

RANGE OF CONCENTRATION OF METALS IN WASTEWATER[1]

Metal	Conc range mg/1	Recommended drinking water stds mg/1	Quality criteria for aquatic life mg/1
Cadmium	<0.008-0.142	0.01	0.0004
Chromium	<0.020-0.700	0.05	0.30
Copper	<0.020-3.36	1.0	0.1 x 96 hr LC_{50}
Mercury	<0.0002-0.044	0.002	0.00005
Nickel	<0.0020-880	No std.	0.10
Lead	<0.050-1.27	0.05	0.01 x 96 hr LC_{50}
Zinc	<0.030-8.31	5.0	0.01 x 96 hr LC_{50}

[1] Results of a recent survey of plants in Michigan.

Metal Removal by Biological Treatment

Biological treatment reduces metal concentrations by widely varying and largely unpredictable amounts. The range of percentage removal obtainable by biological treatment is shown in Table 3. Bearing in mind that if the metals concentrations coming into a waste treatment plant are already low, then the variable and sometimes low percent removals obtained may be acceptable, particularly when adequate dilution is available at the point of discharge. These percent removals, however, would not be adequate to handle those wastewaters that contain the higher influent concentrations.

Table 3

REMOVAL OF METALS BY BIOLOGICAL TREATMENT

Metal	Removal percent
Cadmium	20 – 45
Chromium	40 – 80
Copper	0 – 70
Mercury	20 – 75
Nickel	15 – 40
Lead	50 – 90
Zinc	35 – 80

Metals cannot be destroyed. When a treatment plant removes metals from the liquid flow, they are concentrated in the much smaller flow of sludge. This is illustrated in Table 4. In the sludge, the metals concentration can, indeed, become quite large, ranging from 6.6 mg mercury/kg dry sludge to 2780 mg zinc/kg dry sludge. Obviously, care must be taken on how the sludge is disposed. The much higher concentrations require that precautions be taken that the metals not be redispersed into the environment via the atmosphere during incineration, through leaching into the groundwater from landfills, or through uptake by plants after sludge spreading on land.

Table 4

METALS IN DIGESTED SLUDGE– 33 PLANTS[a]

Metal	Median Value mg/kg[b]
Cadmium	31
Chromium	1100
Copper	1230
Mercury	6.6
Nickel	410
Lead	830
Zinc	2780

[a] Plant sizes ranging from 0.1 mgd to 150 mgd.

[b] Dry Sludge Basis

Metal Removal by Physical-Chemical Processes

Improved removal of metals over that shown by biological treatment can be obtained by physical-chemical systems. These systems were used to investigate the removal of 22 metals in a study by the Wastewater Research Division of EPA at Cincinnati, Ohio. In this study, individual metals and combinations of metals were added to the raw wastewater, and removals obtained in the various unit processes were determined. The 0.25 l/sec (4 gpm) pilot plant system consisted of chemical clarification by a variety of chemicals including lime at varying pH's, alum and iron salts, dual media filtration, and activated carbon. Two carbon contactors were used: one (designated "old carbon") had been in operation for about a year and was in need of regeneration; the other was designated as "new carbon." All waste flows such as chemical sludges and filter backwashes were measured and sampled in order to obtain a materials balance, which served to locate otherwise undetected sources of error.

Typical results for removal of cadmium are shown in Figure 1. Clarification was obtained by ferric sulfate at pH 6 and by lime at pH ~10 and at ~11.5. Coagulation and filtration resulted in > 94 percent removal of cadmium in all three clarification systems. Activated carbon adsorption removed an additional increment resulting

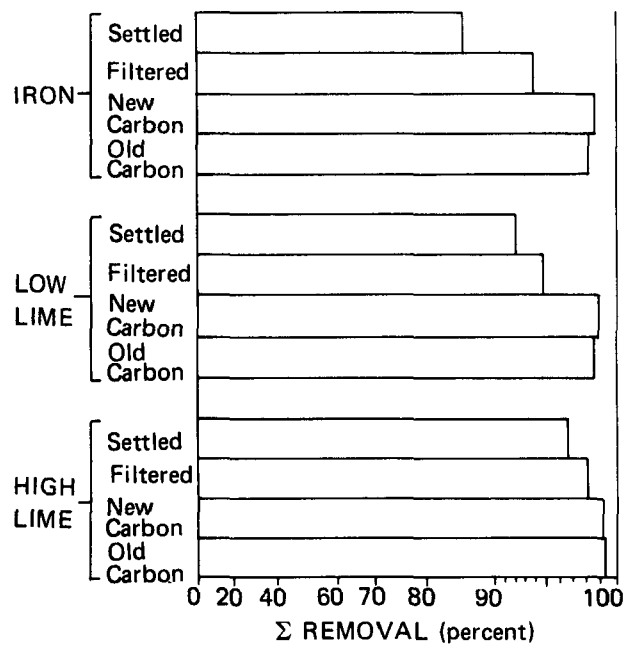


FIGURE 1. Removal of cadmium[11].

in a cumulative removal of about 99 percent of the cadmium. Both the exhausted (old carbon) and fresh (new carbon) contactors were equally effective in removing an increment of cadmium.

The behavior of the various metals in the treatment system varied with each metal. For example, hexavalent chromium is shown in Figure 2. Poor removals were obtained during chemical precipitation largely because of the substantial solubility of the chromium VI compounds. Activated carbon, however, was very effective and resulted in overall removals in excess of 95 percent. The removal of chromium VI may be the result of adsorption but more likely is due to reduction of the soluble hexavalent chromium to the highly insoluble trivalent chromium which is precipitated in the contactor.

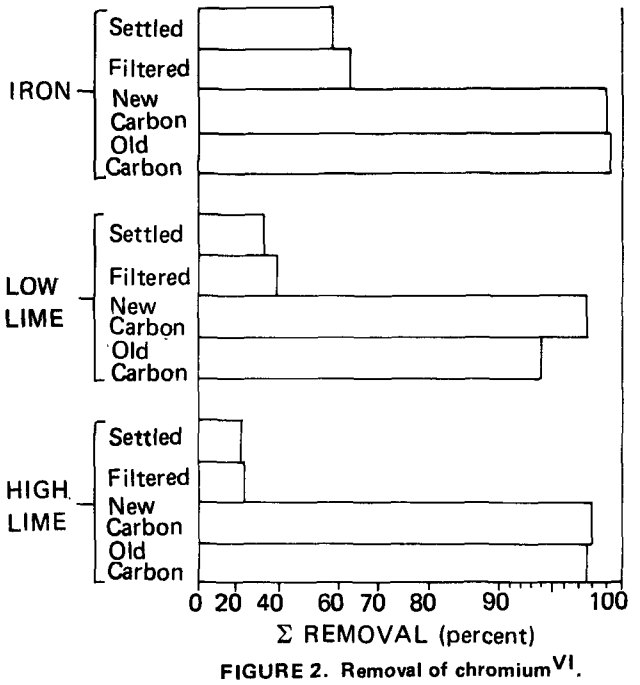


FIGURE 2. Removal of chromium^{VI}.

Mercury, about which there has been considerable concern, is well removed by physical-chemical treatment. An initial concentration of 50-60 μg/1 was reduced to <1 μg/1 providing an overall removal of >98 percent.

This research, as well as the work done by others, has demonstrated that a physical-chemical system is a most effective series of processes for removal of metals. A summary of removals obtained on 22 metals by differing chemical pretreatments is shown in Tables 5, 6, and 7. Coagulation with one or another of the coagulants followed by activated carbon obtained removals exceeding 95 percent for most of the metals, including the toxic metals beryllium, arsenic, mercury, and cadmium. Some deficiencies in removal were exhibited for several metals. Thus, molybdenum is poorly removed by lime but better removal is obtained with ferric salts. Similarly, nickel and manganese are poorly removed by iron salts or alum but readily removed by lime. The right choice of clarification chemical or combinations of chemicals will remove, to a high degree, all of the listed metals. It is not unusual, for example, to use small dosages of ferric salts to improve clarification when using lime.

Plants discharging to water quality limited streams face some difficulties in meeting the stringent requirements for aquatic life shown in Table 2, particularly when minimum dilution water is available in the stream and especially when influent metals concentrations are high. For example, even the high percent removal of 99.6 obtained for cadmium in Table 5 would not be adequate to meet aquatic requirements of 0.0004 mg cadmium/1 unless a dilution of 1-50 were available in the stream. Alternative methods (such as source control) would be required in those instances where high influent concentrations of metals are experienced and where low residuals are imposed by stream standards. This is true for other metals (Tables 5 and 6) where high percent removals result in substantial residuals when the influent concentration is as high as 5 mg/1. Generally, however, influent concentrations are low and most aquatic life requirements can be obtained.

Table 5

REMOVAL OF METALS BY LIME PRECIPITATION-ACTIVATED CARBON

Metal	Initial concentration mg/1	Removal percent	Residual metal μg/1
Silver	0.5	98.	10
Beryllium	0.1	99.5	1
Bismuth	0.6	96.	24
Cobalt	0.5	95.	25
Mercury	0.5	91.	45
Molybdenum	0.5	*	–
Antimony	0.6	52.	288
Selenium	0.5	95.	25
Selenium	0.06	67.	20
Tin	0.5	92.	40
Titanium	0.5	95.3	24
Thallium	0.5	72.	140
Vanadium	0.5	91.	45
Manganese	5.0	98.2	90
Nickel	5.0	99.5	25
Zinc	5.0	76.	1200
Copper	5.0	90.	500
Cadmium	5.0	99.6	20
Barium	5.0	81.	950
Lead	5.0	99.4	30
Chromium	5.0	98.2	90
Arsenic	5.0	84.	800
Mercury	0.5	92.	40

*5% removal based on sludge analysis.

Table 6
REMOVAL OF METALS BY FERRIC CHLORIDE-ACTIVATED CARBON

Metal	Initial concentration	Removal	Residual metal
	mg/1	percent	μg/1
Silver	0.5	99.1	5
Beryllium	0.1	98.9	1
Bismuth	0.5	96.2	9
Cobalt	0.5	30.	350
Mercury	0.05	99.	1
Molybdenum	0.6	80.	120
Antimony	0.5	72.	140
Selenium	0.1	80.	20
Selenium	0.05	75.	13
Tin	0.5	98.5	8
Titanium	0.5	90.	50
Thallium	0.6	45.	330
Vanadium	0.5	97.8	11
Manganese	5.0	17.	4150
Nickel	5.0	37.	3150
Zinc	5.0	94.	300
Copper	5.0	96.	200
Cadmium	5.0	98.6	70
Barium	5.0	95.6	220
Lead	5.0	99.1	45
Chromium	5.0	99.3	35
Arsenic	5.0	97.1	145
Mercury	0.5	98.	10

Table 7
REMOVAL OF METALS BY ALUM-ACTIVATED CARBON

Metal	Initial concentration	Removal	Residual metal
	mg/1	percent	μg/1
Silver	0.6	99.2	5
Beryllium	0.1	98.9	1
Bismuth	0.6	96.9	19
Cobalt	0.8	56.	352
Mercury	0.06	98.3	1
Molybdenum	0.6	10.	540
Antimony	0.6	71.	174
Selenium	0.5	56.	220
Tin	0.6	94.	36
Titanium	0.6	95.8	25
Thallium	0.6	39.	366
Vanadium	0.5	95.4	23
Manganese	0.7	33.	469
Nickel	0.9	37.	567
Zinc	2.5	28.	1800
Copper	0.7	98.3	12
Cadmium	0.7	55.5	312
Barium	0.5	92.	40
Lead	0.6	96.6	20
Chromium (Cr^{3+})	0.7	99.3	5
Chromium (Cr^{6+})	0.7	97.4	18

Activated carbon in the physical-chemical system performs an important function in the overall removal of metals in the system. As Figures 1 and 2 show, activated carbon can, in some instances, provide the additional removal required to yield low residuals in the effluent. The reasons for removal are not known but are probably due to a combination of mechanisms including adsorption, reaction with organics at the carbon surface, filtration of previously precipitated metals, and precipitation with sulfide. Whatever the reasons, the metals are associated with the carbon and are not removed during backwashing. During the organic loading cycle, carbon can assimilate substantial concentrations of metals which become part of the ash content of the carbon after regeneration.

Removal of Metals by AWT System

There has been interest in using wastewater as a source of potable water – after treatment, naturally, to remove as much as technically possible of all pollutants. The treatment system that appears capable of achieving this degree of treatment is a combination of biological and physical-chemical processes. As a category of pollutants, toxic metals have been of some concern.

Table 8 shows some results of a several years' study at Dallas, Texas. Typically, the incoming concentrations for the metals listed are low, consistent with the ranges of metals in wastewater shown in Table 1. The activated sludge process reduces these concentrations by 21-69 percent (Table 8). Activated sludge is followed by lime precipitation (at pH 11.5) and by filtration and activated carbon which extract a further increment of metals. The cumulative removals range from 39-96 percent, finally producing the residuals shown in the last column. What appears to be an inconsistency in

Table 8
REMOVAL OF METALS–DALLAS TERTIARY PLANT

Metal	Plant Influent mg/1	Removal (percent) Activated sludge	Sludge + Tertiary[1]	Effluent mg/1
Cadmium	0.013	39	39	0.008
Chromium	0.215	57	96	0.009
Copper	0.092	33	56	0.041
Mercury	0.00051	69	86	0.00007
Nickel	0.073	21	74	0.019
Lead	0.095	56	53	0.045
Zinc	0.320	65	91	0.029

[1] Lime (pH 11.5), filtration, activated carbon

the percent removals obtained in the tertiary and those obtained in a physical-chemical system treating raw sewage is actually due to the much lower concentrations of metals entering the tertiary system. In the latter, the numerical value of the residual becomes sensitive to the degree of suspended solids removal and to solubility product relationships. Additional removal, if necessary, would require modifications to the process. In terms of metals, this processed wastewater fully qualifies as drinking water: cadmium is 8 μg/1, requirement is 10; chromium is 9 μg/1, requirement is 50; mercury is 0.07 μg/1, requirement is 2.

Discussion

Despite the substantial amount of work done on removal of metals in wastewater treatment, this brief review reveals that much has yet to be learned about how to control the dispersion of metals into the environment. The overwhelming majority of treatment plants in this country consist of some form of biological treatment — activated sludge, trickling filters, and lagoons. As was shown, removal of metals by these processes is variable and unpredictable. To make these processes more effective for metals removal, more information must be obtained on the effects of process variables such as the ratio of oxygen to BOD, sludge age, mean cell residence time, etc. Little is known, for example, of the effect on metals of adding a coagulant to activated sludge for phosphorus control. The problem of disposal of sludge, which contains orders of magnitude with higher concentrations of metals than effluents, remains an area for more research.

It is not certain that the low concentrations of metals produced by physical-chemical treatment are adequate to protect the aquatic environment. While drinking water standards for metals can be achieved, it is known that concentrations lower by as much as an order of magnitude may be required for aquatic life where biomagnification and adsorption on sediments present special problems.

Only a continuing program of research can provide the information needed for the solution to these problems.

The feature article on trace water removal was prepared by Jesse M. Cohen, Municipal Environmental Research Laboratory, U.S. EPA, Cincinnati, Ohio.

REMOTE SENSING WORKSHOP PLANNED

Technology Transfer and the EPA Environmental Monitoring and Support Laboratory have scheduled a Remote Sensing Workshop for the spring of 1977. The purpose of the workshop is to bring experts in this field together to prepare a new Technology Transfer publication. This document will inform and educate regulatory agency personnel about remote sensing techniques that are used to detect and identify pollutants for surveillance and enforcement. Approximately 25 specialists will be invited to participate in this 3-day workshop.

SPECIALTY FOOD SEMINAR

A Technology Transfer Specialty Food Waste Management Seminar was held January 9-12, 1977 at Atlanta's Peachtree Plaza Hotel. The seminar was tailored by a combined EPA/industry committee to specifically address the control of pollution in four food manufacturing areas: dressings and sauces; preserves; processed apples; and vinegars. The agenda covered effluent guidelines, wastewater treatment (primary, secondary, tertiary), pretreatment, financial/management strategies, and case histories.

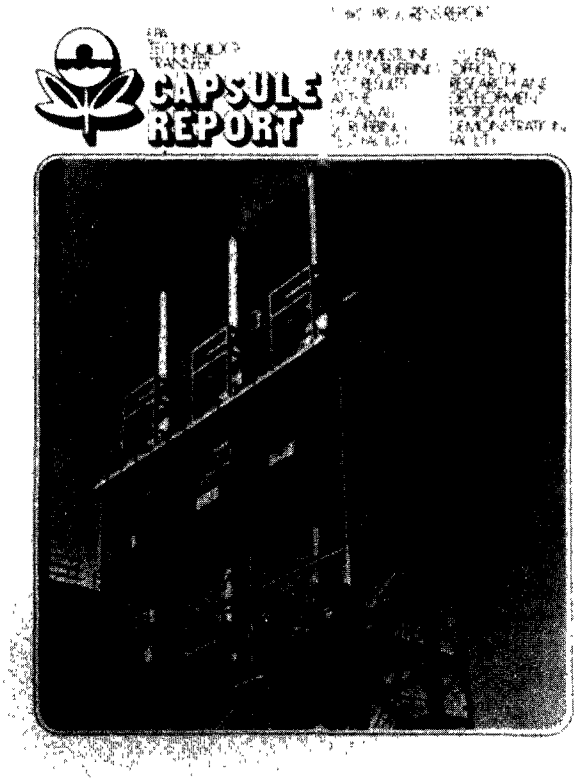
Over 150 industrial representatives attended the seminar and participated in dialogues on subjects such as sampling techniques, plant housekeeping, cost recovery methods, and pollution control management alternatives.

NEW INDUSTRIAL TECHNOLOGY TRANSFER PUBLICATION AVAILABLE— THIRD PROGRESS REPORT ON TVA SHAWNEE LIME/LIMESTONE FGD DEMONSTRATION FACILITY

This is the third in a series of capsule reports describing a program conducted by the EPA to test prototype lime and limestone wet-scrubbing systems for removing sulfur dioxide (SO_2) and particulate matter (fly ash) from coal-fired boiler flue gases. The program, sponsored by the Utilities and Industrial Power Division of the EPA Industrial Environmental Research Laboratory, is being conducted in a test facility which is integrated into the flue gas ductwork of a coal-fired boiler at the Tennessee Valley Authority (TVA) Shawnee Power Station, Paducah, Kentucky. Bechtel Corporation of San Francisco is the major contractor and test director, and TVA is the constructor and facility operator. This report describes initial results of an advanced program of lime and limestone tests (with and without the addition of magnesium oxide), conducted from January 1975 to April 1976. Two earlier capsule reports described the results from the inception of testing in May 1972 until January 1975.

This third capsule report describes limestone utilization tests conducted on two scrubber systems. These tests were designed to substantiate a TVA economic study which showed

that the economics of limestone scrubbing could be improved by increasing limestone utilization (moles SO_2 absorbed/mole Ca added). Increased limestone utilization not only reduces limestone feed requirements but also reduces waste sludge production. Tests were conducted to correlate alkali utilization with scrubber inlet liquor pH, effluent hold tank residence time, and hold tank configuration.



Removal of the entrained mist from the scrubbed flue gas without fouling the mist eliminator system is one of the key factors in successful scrubber operation. Early in the testing program, more difficulty was experienced in keeping the mist eliminator clean on the Turbulent Contact Absorber (TCA) in limestone service than on the spray tower in lime service. This difficulty was initially attributed to differences in scrubber design, which might have caused a finer mist in the TCA. Later it was found that the mist eliminator was much easier to keep clean at a high alkali utilization (above about 85 percent) than at lower utilization. Lime systems operate at an inherently high utilization; limestone systems can operate over a range of utilization.

A 7-week variable load (cycling gas rate) test series with lime was conducted on the venturi/spray tower system from August to October 1975. These tests were designed to evaluate the ability of the scrubber system to handle the variable gas rate and composition resulting from a daily boiler load cycle.

From February to April 1976, lime and limestone factorial tests were performed at the test facility. Approximately 250 runs were made to determine the effects of several scrubber variables on percent SO_2 removal by the venturi (only), the spray tower (operated with minimum flow to the venturi section), and the TCA scrubber.

This third capsule report can be ordered by filling out the form on the last sheet of this newsletter (#2010).

EPA WATER PLANNING DIVISION AND TECHNOLOGY TRANSFER TO SPONSOR THREE REGIONAL 208 CONFERENCES

Technology Transfer and the Water Planning Division of the Office of Water and Hazardous Materials will co-sponsor a series of three regional conferences on Section 208 Management and Implementation. The conferences will disseminate the latest information and technology pertinent to Section 208 of the Water Pollution Control Act and Amendments of 1972 (PL 92-500). Slated to focus on solutions to problems identified in three distinct geographical areas of the country, conferences will be held in Reston, Virginia on March 15-17, 1977; Denver, Colorado on April 19-21, 1977; and St. Louis, Missouri on May 23-25, 1977.

Section 208 of PL 92-500 requires that state and area water quality management agencies develop and implement plans to control and abate water pollution from all sources, point and non-point, within a designated 208-study region or area. Point sources of pollution include municipal and industrial liquid and solid wastes. Non-point sources include agriculture, silviculture, mining, construction, salt water intrusion, and residue disposal. Section 208 further provides that alternative methods for attaining pollution control solutions must be considered.

The 208 Conferences are designed to present, in a period of 3 days, up-to-the-minute institutional, regulatory, technical and economic information to those currently involved in the studies and those who will be involved in future 208 programs. The Institutional/Regulatory Workshops will discuss EPA guidance and regulatory policy; federal/state/local relationships; and plan implementation and management, in addition to other areas. Technical Workshops are designed to give program guidance and implementation in the various point and non-point areas along with technical assessment and control techniques (including alternatives). Handbooks and manuals on these techniques will also be distributed. Areas covered will be urban runoff; agriculture; silviculture; construction; mining; estimating industrial pollution loads; liquid waste sludge; and solid waste disposal.

It is expected that a person attending the

conference will learn EPA policy and guidance in the 208 program. He will learn state-of-the-art techniques in assessment and control of point and non-point sources of pollution. Experts from EPA, the academic world, state and local government, and industry will present useful, practical information, stressing best management practices and costs. Four to six concurrent sessions are planned to minimize the amount of time required for presentation of the information. Most technical sessions will be presented at two different times, allowing for participation in a greater number of sessions.

While maintaining a similar format, the final agenda presented at each conference will be modified to focus on solutions to problems that have been identified as important within each geographical region. Therefore, it will be necessary to attend only the nearest regional conference.

MANUAL RE "METHODS FOR CHEMICAL ANALYSIS OF WATER AND WASTES" BEING UPDATED

The EPA Environmental Monitoring and Support Laboratory is updating the manual entitled "Methods for Chemical Analysis of Water and Wastes" and it should be ready for distribution by Technology Transfer in December 1977. Copies now being distributed are reprints of the 1974 manual and the former errata sheet is now reflected in the body of the text. Copies can be obtained by using the order form at the back of this newsletter.

TECHNOLOGY TRANSFER MUNICIPAL DESIGN SEMINARS ON SMALL WASTEWATER TREATMENT SYSTEMS

A new Technology Transfer seminar series has been developed to cover the design of small wastewater treatment community systems of less than 1 MGD and individual home or on-site wastewater treatment devices. The program will feature three, 4-hour concurrent sessions dealing with on-site systems, residuals management and alternative collection systems, and community treatment systems. The seminar will be initiated with a 4-hour general session featuring presentations by the regional administrator, regional and national Technology Transfer personnel, and by experts from the Office of Water Program Operations, and state agencies. The final 4-hour general session will present the methodology for making an alternative analysis of potential treatment systems for a community.

Speakers for the technical sessions will include Professors William Boyle and R. J. Otis, University of Wisconsin; Ivan Cooper and Joseph Rezek of Rezek, Henry, Meisenheimer and Gende, Libertyville, Illinois; Jim Kreissel, U. S. EPA, Cincinnati, Ohio; Gordon Culp, Clean Water Consultants, El Dorado Hills, California; E. Joe Middlebrooks, Middlebrooks and Associates, Logan, Utah; and Jerrold J. Troyan, Brown and Caldwell, Eugene, Oregon.

Below are listed six scheduled locations and dates for the seminars. It is anticipated that the seminar will eventually be held in all 10 regions. If interested in attending one of these seminars, contact your regional TT Chairman for additional information. His name, address, and phone number appear in the back of this newsletter.

Date	Location of Seminar
March 8-10, 1977	Portland, Ore.
March 29-31, 1977	Philadelphia, Pa.
April 26-28, 1977	Kansas City, Mo.
May 4-6, 1977	Boston, Mass.
May 17-19, 1977	San Francisco, Calif.
June 7-9, 1977	Denver, Colo.

TECHNOLOGY TRANSFER SEMINAR ON GUIDANCE FOR IDENTIFYING AND ASSESSING POLLUTION FROM MINING AND CONSTRUCTION ACTIVITIES

The third Technology Transfer Seminar on Section 208 of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500) was held in Atlanta, Georgia on November 4-5, 1976. Approximately 100 public officials, individuals from planning agencies, conservation groups, mining and construction industries, and state and federal governments attended the seminar.

Jack E. Ravan, Region IV Administrator, addressing audience at Technology Transfer's 208 Seminar in Atlanta, Ga.

Purpose of the seminar was to present an approach to 208 planning for non-point sources of pollution and to discuss the specific needs in construction and mining activities. In the con-

struction area, presentations were given on assessing the problem and determining the solutions; Federal Highway Program regulations including monitoring and implementation; costs and incentives; and the State of North Carolina's program to regulate pollution from construction activities—organization, resources, costs, implementation, monitoring and results.

In the mining area, presentations included identification/assessment alternatives and a recommended approach to planning and implementation of controls; improving the effectiveness of state mining regulatory control programs in Kentucky; a case history on phosphate mining controls in Florida; and non-point source problems as seen by a miner.

The second day consisted of a workshop in which dialogue with seminar participants was held to discuss what was being done by federal, state, and local agencies and industries in controlling, monitoring, and regulating non-point sources of pollution from construction and mining activities.

Key presentations were made by James W. Crooks and Gene McNeill, U.S. EPA, Region IV, Atlanta; O. M. Stump, FHWA, Region IV, Atlanta; Harlan Britt, DNR, State of North Carolina; William S. Forester, DNR, State of Kentucky; Tim Stewart, DER, State of Florida; C. Christopher of Hagy, Sutherland, Asbill and Brennan, Atlanta; and David Green, Robert Thronson and Dan Deely, U. S. EPA, Water Planning Division, Washington, D.C.

For details about future seminars on this subject, contact the appropriate Technology Transfer Chairman listed in the back of this newsletter.

METAL FABRICATING SEMINAR

Over 120 industrial representatives attended a 2-day Technology Transfer seminar, "Upgrading Metal Machining, Fabricating and Coating Operations to Reduce Pollution." The seminar, held November 30-December 1 in Philadelphia, Pa., attracted industrial decision-makers who are responsible for selecting, purchasing, designing, or operating pollution control equipment. The seminar's technical sessions emphasized proven and available practical solutions for the control of air and water pollutants; the reduction of wasteloads; and the treatment, disposal, or recovery of waste products and heat.

The seminar will also be held in Boston, Massachusetts, February 23-24, 1977. In addition, because of its popularity, plans are being made to conduct it in Dallas and Chicago in the spring. For details on these future seminars, contact the appropriate Technology Transfer Chairman listed in the back of this newsletter.

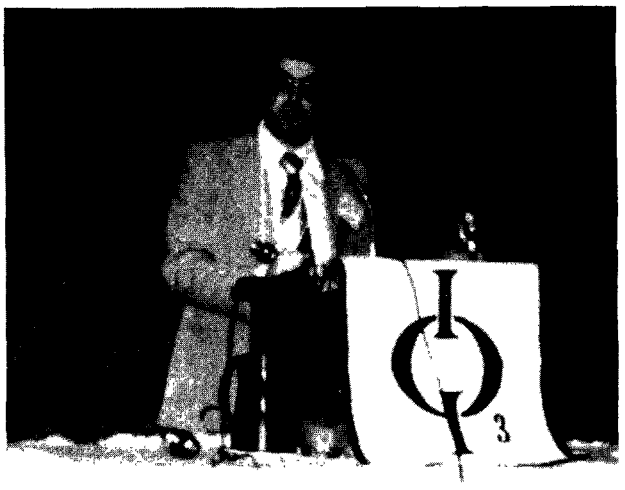
"FOREST HARVESTING AND WATER QUALITY" – SECOND TECHNOLOGY TRANSFER BROCHURE ON FOREST PRACTICES IN THE PACIFIC NORTHWEST

A new Technology Transfer publication, "Forest Harvesting and Water Quality," prepared by EPA's Region X, highlights forest harvest activities which can cause environmental damage and suggests some management practices aimed at preventing or minimizing adverse impacts on surface waters. The forest and its harvestable timber is a valuable resource. In the Pacific Northwest alone, there are some 64.8 million acres classified as commercial forest. Proper management of this resource carries responsibilities for protection of the forest environment. Improper harvest practices can be destructive not only to the immediate harvest area but to countless miles of streams. This publication can be obtained by checking off the appropriate box (#5013) on the order form in the back of this newsletter.

WORKSHOP–OZONE/CHLORINE DIOXIDE

A workshop on "Ozone/Chlorine Dioxide Oxidation Products of Organic Materials," co-sponsored by the International Ozone Institute and Technology Transfer was held November 16-19 in Cincinnati. Over 300 scientists, engineers, regulatory personnel, and academics from around the world attended the workshop.

During the 3-day workshop, over 25 papers dealing with the chemistry and toxicology of various organic materials were given. Topics of some of the papers were as follows: Ozone as a Disinfectant of Water; Reactions of Ozone in Aqueous Systems; Methods for Evaluating the Mutagenic Activity of Ozonated Chemicals;



Wolfgang Kuhn of the Universität Karlsruhe, Federal Republic of Germany, addressing the audience at the IOI Workshop.

Identification of End Products Resulting from Ozonation of Compounds Commonly Found in Water; and Use of Chlorine Dioxide in Water and Wastewater Treatment.

Key speakers during the workshop included Victor Kimm, Deputy Assistant Administrator for Water Supply, U.S. EPA; Phillip Harteman, Ph.D., INSERM, Nancy, France; Wolfgang Kuhn, Universität Karlsruhe, Federal Republic of Germany; and James M. Symons, Municipal Environmental Research Laboratory, U.S. EPA.

Proceedings from this workshop can be obtained from the International Ozone Institute, Skytop Complex, Merrill Lane, Syracuse, New York 13210.

Jack Mills of Dow Chemical Co. and Walter J. Blogoslawski, National Marine Fisheries Service, during one of the Technical Sessions at the IOI Workshop.

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 your EPA Regional Technology Transfer Committee Chairman from the list below:

REGION	CHAIRMAN	ADDRESS
I	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.)
II	Robert Olson	Environmental Protection Agency 26 Federal Plaza New York, New York 10007 212 264-1867 (N.Y., N.J., P.R., V.I.)
III	Albert Montague	Environmental Protection Agency 6th & Walnut Streets Philadelphia, Pennsylvania 19106 215 597-9856 (Pa., W. Va., Md., Del., D.C., Va.)
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VI	Mildred Smith	Environmental Protection Agency 1201 Elm Street First International Building Dallas, Texas 75270 214- 749-3971 (Texas, Okla., Ark., La., N. Mex.)
VII	John Coakley	Environmental Protection Agency 1735 Baltimore Avenue Kansas City, Missouri 64108 816 374-5971 (Kansas, Nebr., Iowa, Mo.)
VIII	Elmer Chenault	Environmental Protection Agency 1860 Lincoln Street Denver, Colorado 80203 303 837-4343 (Colo., Mont., Wyo., Utah, N.D. S.D.)
IX	William Bishop	Environmental Protection Agency 100 California Street San Francisco, Calif. 94111 415 556-6925 (Calif., Ariz., Nev., Hawaii)
X	John Osborn	Environmental Protection Agency 1200 6th Avenue Seattle, Washington 98101 206 442-1296 (Wash., Ore., Idaho, Alaska)

For the following audio-visual material, please contact your Regional Transfer Chairman. (See above)

MOTION PICTURES (16mm sound)

- Richardson, Texas Project—Title: "Somebody around here must be doing something good." (15 min.)
- Phosphorus Removal (5 min.)
- Water Quality Management, Alameda Creek, Calif.—Title: "The Water Plan." (28½ min.)
- The Seattle METRO Story. (28 min.)
- "Breakthrough at Clear Lake" (28 min.)

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 the previous section of this newsletter.

SUBJECT	DATE	REGION/CITY	
Scheduled Industrial Seminars			
Specialty Foods	January 9-12, 1977	IV	Atlanta, Ga.
Metal Fabricating	February 23-24, 1977	I	Boston, Mass.
Metal Fabricating	March 23,24, 1977	V	Chicago, Ill.
Tentative Industrial Seminars			
Metal Fabricating	April 1977	VI	Dallas, Tex.
Metal Fabricating	April 1977	IX	Los Angeles, Calif.
Wood Products	Summer 1977	VIII	Denver, Colo.
Wood Products	Summer 1977	VI	Texarkana, Tex.
Wood Products	Summer 1977	IX	Redding, Calif.
Scheduled Municipal Seminars			
Small Wastewater Treatment Systems	March 8-10, 1977	X	Seattle, Wash.
Small Wastewater Treatment Systems	March 29-31, 1977	III	Philadelphia, Pa.
Small Wastewater Treatment Systems	April 26-28, 1977	VII	Kansas City, Mo.
Small Wastewater Treatment Systems	May 4-6, 1977	I	Boston, Mass.
Small Wastewater Treatment Systems	May 17-19, 1977	IX	San Francisco, Calif.
Small Wastewater Treatment Systems	June 7-9, 1977	VIII	Denver, Colo.
Scheduled "208 Planning" Seminars			
208 Management and Implementation	March 15-17, 1977	III	Reston, Va.
Tentative "208 Planning" Seminars			
208 Management and Implementation	April 19-21, 1977	VIII	Denver, Colo.
208 Management and Implementation	May 23-25, 1977	VII	St. Louis, Mo.

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REQUEST FOR TECHNOLOGY TRANSFER MATERIAL

The publications listed on this form are the only ones available through the Office of Technology Transfer.

Please send me the following publications at no charge. (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 ☐

TECHNICAL CAPSULE REPORTS

- Recycling Zinc in Viscose Rayon Plants . . . . . .2001 ☐
- Color Removal from Kraft Pulping Effluent by Lime Addition . . . . . .2002 ☐
- Pollution Abatement in a Copper Wire Mill . . . . . .2003 ☐
- First Interim Report on EPA Alkali SO_2 Scrubbing Test Facility . . . . . .2004 ☐
- Dry Caustic Peeling of Peaches . . . . . .2005 ☐
- Pollution Abatement in a Brewing Facility . . . . . .2006 ☐
- SO_2 Scrubbing and Sulfuric Acid Production Via Magnesia Scrubbing . . . . . .2007 ☐
- Second Interim Report on EPA Alkali Scrubbing Test Facility . . . . . .2008 ☐
- Magnesium Carbonate Process for Water Treatment . . . . . .2009 ☐

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 Investments . . .3005 ☐
- Erosion and Sediment Control from Surface Mining (2 Vols.) . . . . . .3006 ☐

MUNICIPAL SEMINAR PUBLICATIONS

- Upgrading Lagoons . . . . . .4001 ☐
- Physical-Chemical Treatment . . . . . .4002 ☐
- Nitrification/Denitrification . . . . . .4004 ☐
- Upgrading Existing Wastewater Treatment Facilities—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 ☐

BROCHURES

- Logging Roads and Water Quality . . . . . .5011 ☐
- Municipal Wastewater Alternatives . . . . . .5012 ☐
- Forest Harvesting and Water Quality . . . . . .5013 ☐

HANDBOOKS

- Analytical Quality Control in Water and Wastewater Laboratories (1972) . . . . . .6001 ☐
- Monitoring Industrial Wastewater (1973) . . . . . .6002 ☐
- Methods for Chemical Analysis of Water and Wastes (1974) . . . . . .6003 ☐

INDUSTRIAL ENVIRONMENTAL POLLUTION CONTROL MANUALS

- Pulp and Paper Industry — Part I/Air . . . . . .7001 ☐

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INTERNATIONAL PUBLIC WORKS SHOW

Technology Transfer is participating as an exhibitor at the Internal Public Works Congress and Equipment Show being held September 25-30, 1976 in Las Vegas, Nevada.

The theme of the Technology Transfer Exhibit being displayed at the International Public Works Show is the new publication "Environmental Pollution Control Alternatives: Municipal Wastewater", which will be available free of charge at the Technology Transfer booth.

Host region for this year's meeting is EPA's Region IX. Mr. Paul DeFalco serves as Regional Administrator of Region IX, with responsibility for environmental protection activities in Arizona, California, Hawaii, Nevada, Guam, American Samoa, and the Pacific Islands Trust Territories.

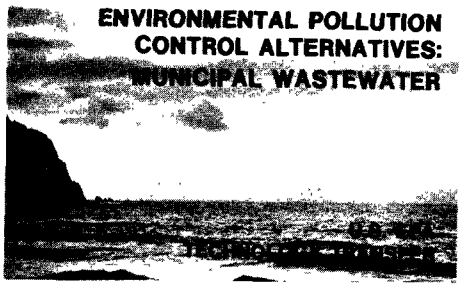
Paul DeFalco, Jr.
Region IX Administrator

George R. Alexander, Jr.
Region V Administrator

WPCF CONFERENCE

For the sixth consecutive year, EPA Technology Transfer is participating in the Annual Conference of the Water Pollution Control Federation. This year's meeting - the 49th Annual WPCF Conference - is being held in Minneapolis, Minnesota, October 3-8, 1976. Technology Transfer will have a booth in the exhibit area of the WPCF Conference at which the newly printed "Environmental Pollution Control Alternatives: Municipal Wastewater" will be available.

Host region for this year's meeting is EPA's Region V, which also hosted the 1973 WPCF Annual Conference. George R. Alexander, the Regional Administrator, will be on hand at the opening of the Conference, which annually attracts thousands of the nation's top pollution control experts.



ALTERNATIVES FOR MUNICIPAL WASTEWATER TREATMENT SUBJECT OF NEW TECHNOLOGY TRANSFER PUBLICATION

"Environmental Pollution Control Alternatives: Municipal Wastewater" is the title of the newest semi-technical Technology Transfer publication. This full-color publication presents, in one place, all the available alternative tech-

nologies involved in the treatment of municipal wastewater. Among the technologies covered in this document are physical-chemical treatment, nitrogen control and removal techniques, phosphorus removal techniques, oxygen aeration, carbon adsorption, sludge handling and disposal technology, land treatment, and flow equalization. For each technology, information on treatment efficiency, power requirements, operation and maintenance considerations, costs, land requirements, and actual installations is presented.

This publication will be available for the first time at the Technology Transfer booths at the International Public Works Congress and Equipment Show, September 25-30, 1976, in Las Vegas, Nevada and at the 49th Annual Conference of the Water Pollution Control Federation, October 3-8, 1976, in Minneapolis, Minnesota. Copies can also be obtained by using the order form at the back of this newsletter.

TECHNOLOGY TRANSFER NATIONAL CONFERENCE ON NITROGEN CONTROL

Technology Transfer's first national conference was on the subject of nitrogen control and was held July 27-29, 1976 in Chicago, Illinois. Unlike previous seminars, which were offered on a regional basis, this conference drew attendees from all EPA Regions. Interest in nitrogen control continues to be high, with attendance at this conference exceeding 300 consulting engineers, state and federal regulatory personnel, and municipal engineers.

Each attendee received the Technology Transfer *Process Design Manual for Nitrogen* Control and supplementary handouts covering additional nitrogen control case histories. The conference also featured a field trip to a nitrogen control facility operated by the Metropolitan Sanitary District of Greater Chicago.

Key presentations were made by: Gordon Culp, Clean Water Consultants, El Dorado, California; Donald Ehreth, U.S. EPA, Washington, D.C.; Dr. Cecil Lue-Hing, Alan Obayashi, T.B.S. Prakasam, and David Zenz, Metropolitan Sanitary District of Greater Chicago; Dr. Denny Parker and Richard Stone, Brown and Caldwell Consulting Engineers, Walnut Creek, California; B.W. Ryan, Harris County Water Control and Improvement District #50, Seabrook, Texas; Dr. Clair N. Sawyer, Sun City, Arizona; and Thomas Wilson, Greeley and Hansen, Chicago, Illinois.

Future seminars on nitrogen control are planned and detailed information on these can be obtained from the appropriate Technology Transfer Regional Chairman listed in the back of this newsletter.

PETROLEUM FACILITIES AS POTENTIAL SOURCES OF POLLUTION IN SOUTHWEST KANSAS

The Environmental Photographic Interpretation Center (EPIC), an associate laboratory of EPA's National Environmental Research Center in Las Vegas and under the guidance of the Assistant Administrator for Research and Development, has recently completed a pilot study to determine the location of oil production and storage facilities in four southwestern counties of Kansas. The study was initiated upon the request of EPA's Region VII Surveillance and Analysis Division and was intended to support the Region's "Spill Prevention" activities under Section 311 of the Water Pollution Control Act.

The purpose of this study was to survey late date overhead imagery for the location of oil storage tanks, oil spills, and associated spill prevention characteristics and making this data more easily recognizable to field inspection teams. The project area which encompasses 2,706 square miles includes the counties of Grant, Morton, Stanton and Stevens of the state of Kansas. Underlying this area is a large producing gas field. In addition to the numerous existing gas wells found throughout the project area, oil pumping operations are taking place in order to extract a grade of crude which can presently compete in today's higher priced oil market. Many of these operations are considered to be wildcat operations, which tend to ignore pollution protection requirements.

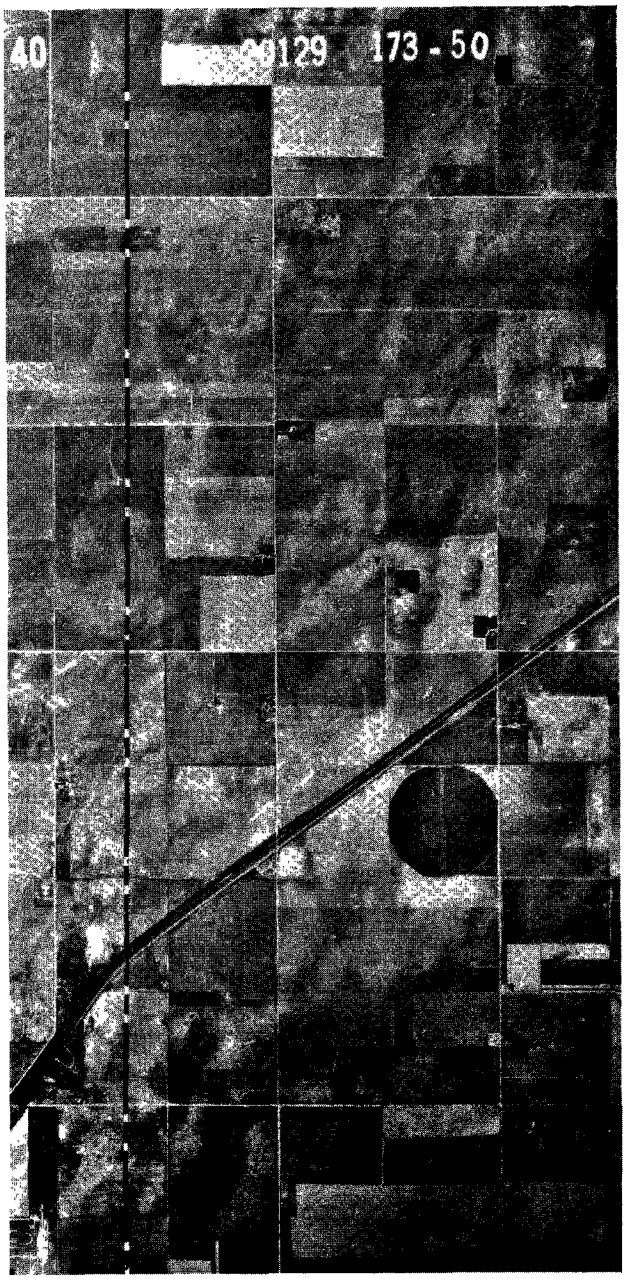
The photographic analysis was extracted from late 1974, high altitude, high resolution, black and white aerial photography. In conjunction with the utilization of this high resolution aerial photographs, 1973, U.S. Department of Agriculture, ASCS photography (Example A) was used to accumulate baseline data.

In order to provide a beneficial product that could be used and plus save the field inspection teams valuable time and money, it was decided that the format for this study would be the presentation of a series of annotated overlays keyed to 1:24,000 topographic maps (Example B). Where topographic maps of this scale were nonexistent, county road maps were utilized. Although these county road maps did not provide terrain relief, they did furnish drainage features, roads, railroads, and built-up areas for necessary locational purposes. Forty-four annotated overlays of this vast area were compiled in approximately six weeks for use.

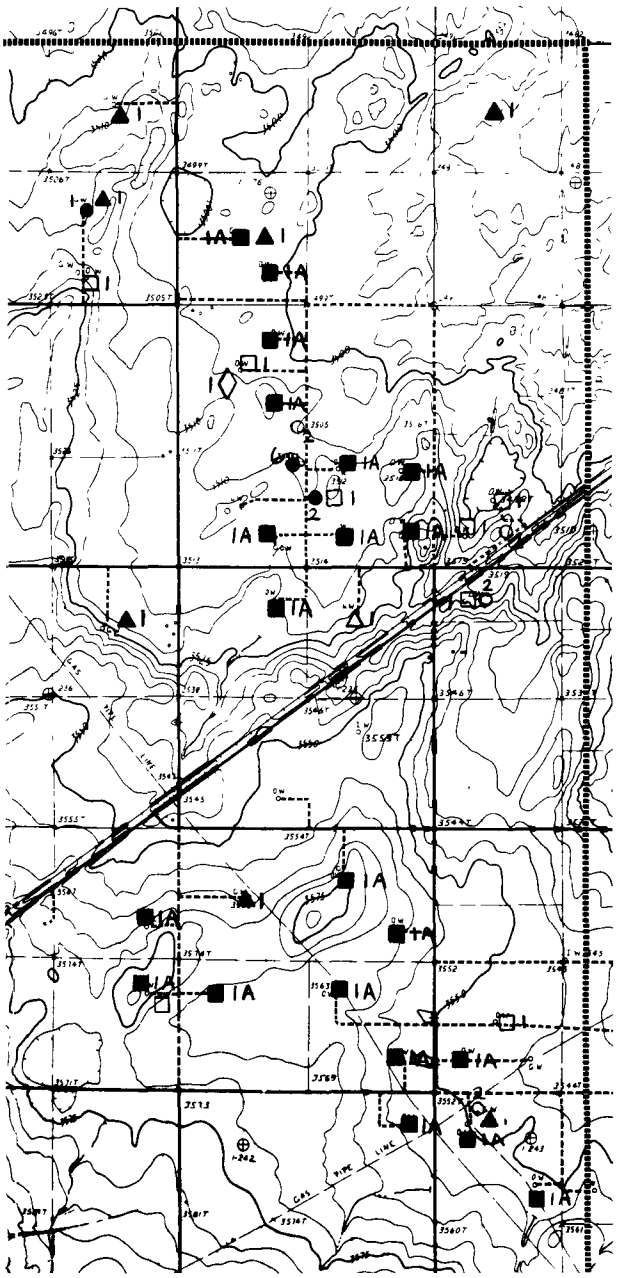
Resulting from this study the following observations were made:

1. Through the use of high altitude, high resolution imagery this program demon-

EXAMPLE A



EXAMPLE B



The analysis for this study was derived from a high altitude/high resolution Photographic System. U.S. Dept. of Agriculture, ASCS imagery such as the above was used as a collateral source. Area to the right of dashed line is shown as actual ground coverage on Example B.

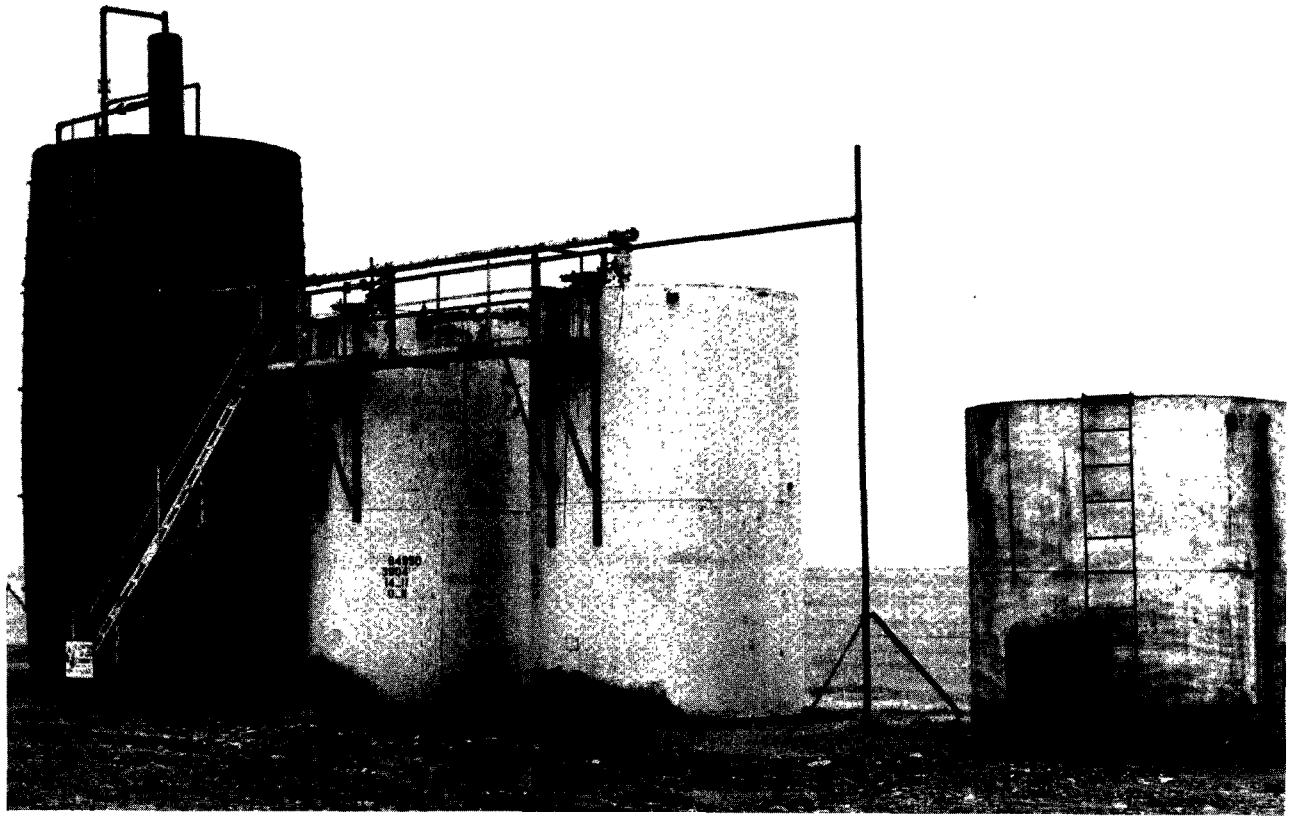
strates the feasibility of detection and location of actual or potential oil-associated pollution sources.

2. Demonstrates a definite aid to field investigation teams in expediting their field operations and in so doing reduces man-hours and costs for such investigations.

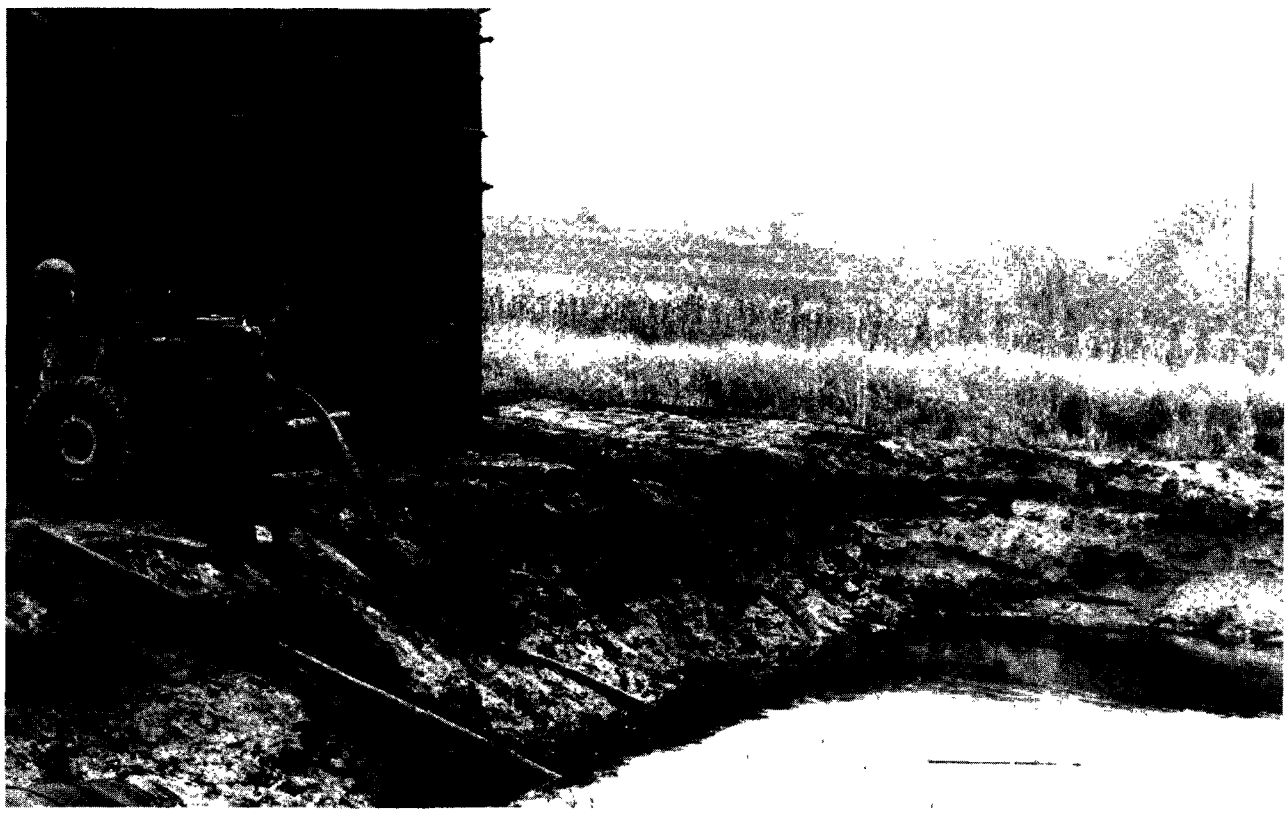
Region VII has commented upon this program by stating: "This approach for pollution abatement certainly has promise for large scattered production fields. The savings in travel time and man-hours could be shortened significantly during the SPCC inspection trips."

THIRD NATIONAL WATEREUSE CONFERENCE

The Third National WateReuse Conference was held in Cincinnati, Ohio, June 27-30, 1976. The Conference, jointly sponsored by the American Institute of Chemical Engineers (AIChE) and Technology Transfer, had the theme of "Symbiosis as a Means of Abatement for Multi-Media Pollution." Ninety topics and papers were presented at the gathering — each emphasizing pollution control via cooperation



The above illustrates a typical crude oil storage facility. This type of tank "battery" usually serves three to six wells. The tank to the left seperates the water from the oil. The two tanks in the center are for crude storage.



"Sludge Pits" are sometimes associated with oil field storage facilities.

Lawrence K. Cecil, AICHE, opens the Third National Watereuse Conference.

Helen Fenske, representing EPA Administrator Russell Train, discusses past and future challenges to EPA at Watereuse Conference.

among industrial, municipal, and/or agricultural interests.

This conference is part of a continuing series which centers around the technical and economical factors of approaching the goal of zero discharge of aqueous wastes by water reuse. Copies of the conference proceedings are available through AIChE, 345 East 47th Street, New York, N.Y. 10017.

TWO INDUSTRIAL SEMINARS SCHEDULED

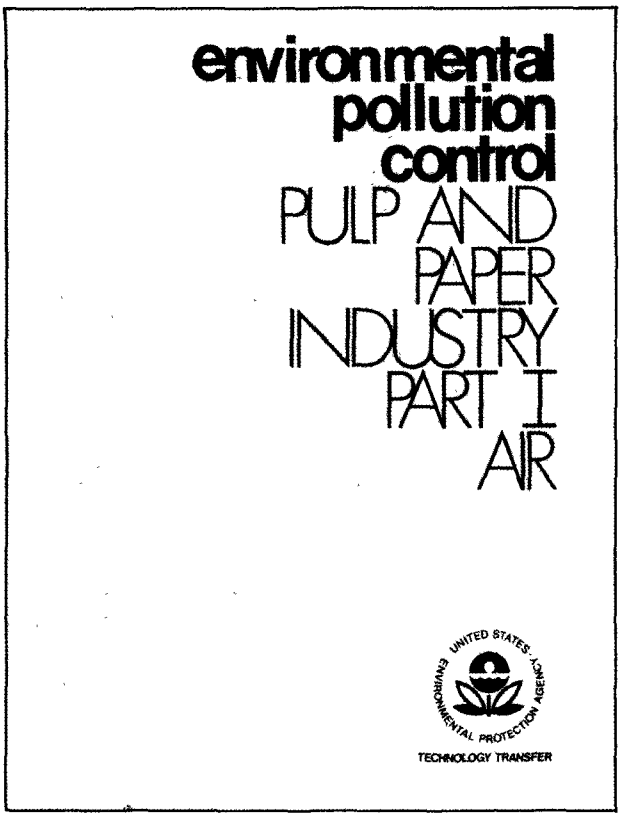
To industrial seminars, entitled "Upgrading Metal Fabricating, Assembly, and Coating Operations to Reduce Pollution," are scheduled for this winter. The first seminar is to be held in Philadelphia during November; the second is planned for Boston in January. Each of the two-day seminars stresses the engineering and economic considerations of multi-media pollution control. Presentations are being prepared by EPA officials, consultants, and industrial representatives. A round table discussion at the end of the second day will conclude each seminar. The seminar dates and locations will be selected after receiving recommendations from the trade associations.

NEW TECHNOLOGY TRANSFER PUBLICATION FOR AIR POLLUTION CONTROL IN THE PULP AND PAPER INDUSTRY

A comprehensive document covering all aspects of air pollution control in the pulp and paper industry has been prepared by EKONO, Inc. for Technology Transfer and is now available for distribution.

This publication, directed towards the process and design engineer, describes types, quantities, and sources of emissions, presents the latest control device alternatives, and estimates costs for implementing the air pollution control systems. Emphasis is placed on explanation of chemical and physical processes which generate emission in specific unit operations so that the advantages and disadvantages of both internal and external process control methods can be understood. Actual field installations have provided the basis for the majority of design data.

New Source Performance Standards (NSPS) are currently being proposed for air emissions in the pulp and paper industry. This new Tech-



nology Transfer publication enables plant personnel to evaluate the best control technology for their specific application.

To order your copy of this publication, use the order form at the back of this newsletter.

SIGNIFICANCE OF NON-POINT SOURCE POLLUTION

The importance of non-point source (NPS) pollution can readily be appreciated by comparing it with point sources of pollution. Examples of point and non-point sources of potential pollution follow:

Non-Point Sources
Agriculture
- Cropping practices
- Livestock production
- Manure Disposal

Silviculture
Mine Pollution
Hydrologic Modifications
Construction Pollution
Saltwater Intrusion
Irrigation Return Flows
Land Disposal of Wastes
Subsurface Injection
Urban Runoff
Land Treatment Processes
- Effluent Disposal
- On-Site Disposal
  - (Septic Tanks)

Point Sources
Municipal Sewerage Systems
Industrial Wastes

Ninety-seven percent of the nation's area is rural in nature and essentially all of it is a potential source of non-point source pollution to some degree. Sediment is the greatest contributor to non-point pollution. It is estimated that some 3 billion tons of sediment per year run off the land into streams. Of this amount, approximately 25% originates from agricultural lands. However, together with the sediment, 3 million tons of nitrogen, 4.5 million tons of phosphorus, and 45 million tons of potassium also run off.

In comparison, a sewered population of 160 million people with a sewage contricution of 100 gpcd, and nitrate and phosphate concentrations in the secondary sewage treatment plant effluent of approximately 25 ppm and 12 ppm, respectively, contributes approximately 125,000 tons/yr of nitrogen and 25,000 tons/yr of phosphorus. These are orders of magnitude less than the contributions from sediment runoff alone.

It is estimated that approximately 7.5 million tons of sludge is produced annually from the treatment of municipal wastes. This will increase to about 11 million tons by 1985.

The total quantity of sludges generated nationally from the treatment of industrial wastewater is estimated to have been approximately 23 million tons per year in 1971. By virture of the implementation by industry of the treatment requirements of PL 92-500, this value is expected to increase by more than 60 percent to 38 million tons by 1977, and to approximately 47 million tons by 1983. The breakdown by industry is illustrated in Table 1.

Table 1

NATIONAL GENERATION OF WASTEWATER SLUDGE FROM THE MAJOR INDUSTRIAL SECTORS (in 10^6 tons)

	1971	1977	1983
Inorganic	17.07	26.02	32.00
Iron and Steel	3.47	6.85	8.03
Pulp and Paper	1.08	2.24	3.41
Meat Products	0.42	0.92	1.09
Petroleum Refining	0.69	0.85	1.02
Textiles	0.19	0.52	0.74
Organic	0.21	0.41	0.48
Plastics & Synthetics	0.14	0.24	0.32
Fruits & Vegetables	0.05	0.07	0.11
Electroplating	0.04	0.07	0.07

A further comparison between various sources of sludges is illustrated in Figure 1.

Another comparition is between BOD discharges to streams from municipal wastes and animal feedlots. Figure 2 illustrates the contributions of each. Municipal contributions will decrease dramatically due to the construction of sewage treatment plants. The confined animal feeding industry is also implementing pollution control techniques to minimize rampant runoff into streams. It is assumed, therefore, that relative discharges to streams will approximate those of the municipalities. If only 0.5% to 1% of the animal waste products are involved in runoff to streams, the BOD loads are similar to those from municipalities. Obviously the significance of this source of pollution will vary from basin to basin as well as from different parts of the country. However, this source is only one of the potential non-point sources as has been noted. Add the other non-point sources and it is rapidly realized that non-point sources will become the major source of pollution.

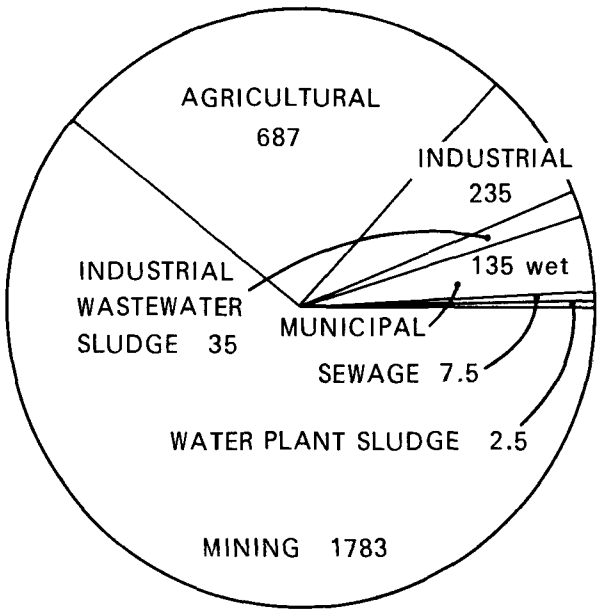


FIGURE 1. Estimated Annual production rates for different types of Solid and Semisolid Wastes (1970-1974) (Dry Weight in Million Tons per Year)

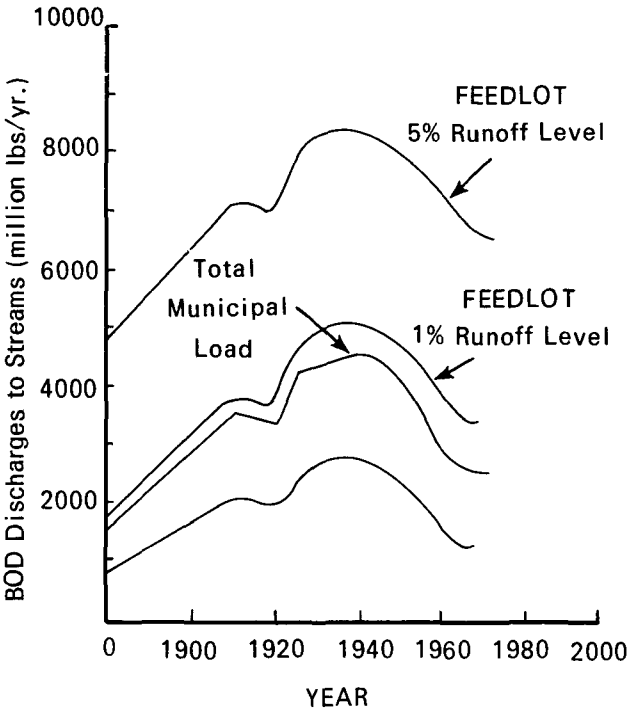


FIGURE 2. Comparison of BOD Discharge to Streams from Municpalities and Animal Feedlots.

A comparison of urban runoff with municipal wastewaters is shown in Table 3. According to this table, surface runoff has approximately the same characteristics as secondary plant discharges. However, this data is based upon average runoff considerations during a storm. Other data indicate that almost all of the mass runoff occurs during the first 10 minutes of a storm. In this regard mass loadings would be more representative of actual stormwater contributions such as was found for Roanoke, Virginia (Figure 3).

The magnitude and importance of urban runoff is further emphasized by considering the impact of pollutants in the air that are deposited during precipitation events. Rainout is not too often considered as a source of pollution; however, Figures 4 and 5 indicate otherwise.

Construction and urbanization develop about 1,000,000 acres per year. Although construction-related activities are relatively simply controlled and impact, at most, 4% as much land as crop agriculture, the soil-disturbing activity not only generates sediment at a much greater rate than crop agriculture but poses a potential serious threat to water quality in many areas.

Surface mining has to date disturbed more than 3,000,000 acres of land and an equal amount has been dedicated to the storage of mineral wastes from mining activities. Surface mining at present continues to affect about 350,000 acres of land annually. In the Northern Appalachia coal fields alone, mine drainage results in a discharge of more than 1,100,000 tons of acidity per day to the surface and ground water in addition to high annual sediment loads.

What has been the effect of the aforementioned and other non-point source discharges on water quality? Up to now, only subjective national estimates have been made by EPA Regional Offices and states. In 1972, the

Table 3

COMPARISON OF URBAN RUNOFF WITH MUNICIPAL WASTEWATERS

Type	BOD_5, mg/1	SS, mg/1	Total coliforms, MPN/100 m1	Total nitrogen, mg/1 as N	Total phosphorus, mg/1 as P
Untreated municipal	200	200	5×10^7	40	10
Treated municipal					
Primary effluent	135	80	2×10^7	35	8
Secondary effluent	25	15	1×10^3	30	5
Combined sewage	115	410	5×10^6	11	4
Surface runoff	30	630	4×10^5	3	1

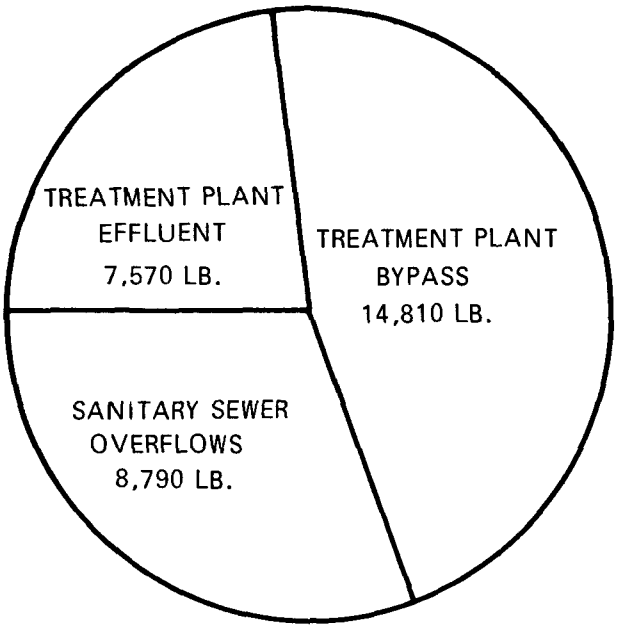


FIGURE 3. Mass Comparison of Storm Runoff with Mun Municipal Wastewater for Roanoke, Virginia (Discharge to Roanoke River).

Regional Offices estimated that approximately 35% of the Nation's waterways had water quality standards violations and that approximately 40% of these problems were attributable to non-point sources. More recently, states have estimated that discharges from these sources have resulted in water quality degradation and in-stream ecological damage in every state in the Nation. Approximately 15% of the Nation's waters are failing to meet water quality standards due to non-point sources and another 35% are equally degraded by a combination of discharges from point and non-point sources.

Examples of the approaches to be followed in coping with the non-point source problem include: site practices to reduce unnecessary erosion which not only creates sediment problems in the streams, but also diminishes the productivity of the land; reclamation of strip-mined areas to allow a reasonable use of the land in the post-mined phase and at the same time prevent entry of acids, dissolved minerals, and sediments into the waters; reasonable use of agricultural chemicals; and improved land development practices in connection with new

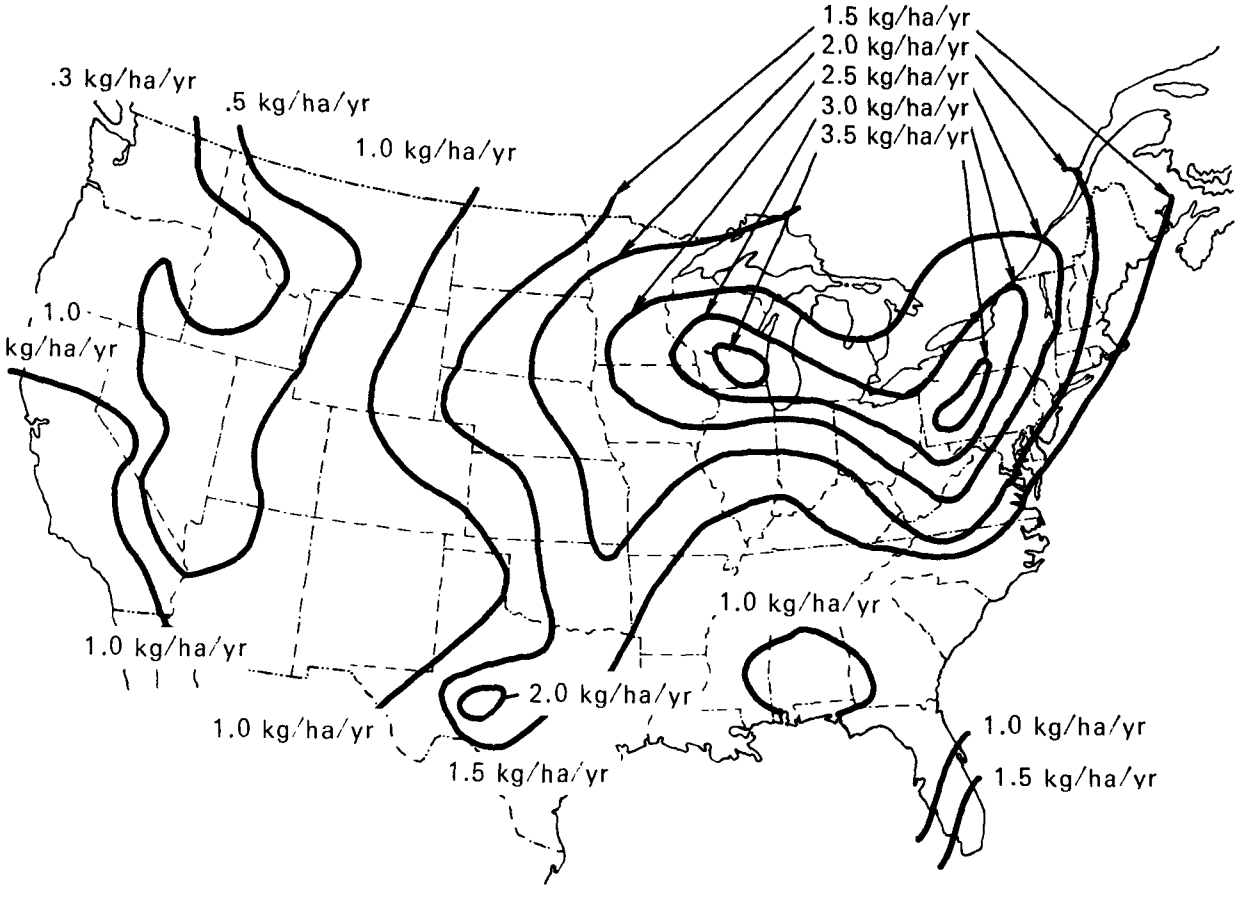


FIGURE 4. Nitrogen (NH_4-N and NO_3-N) in precipitation.

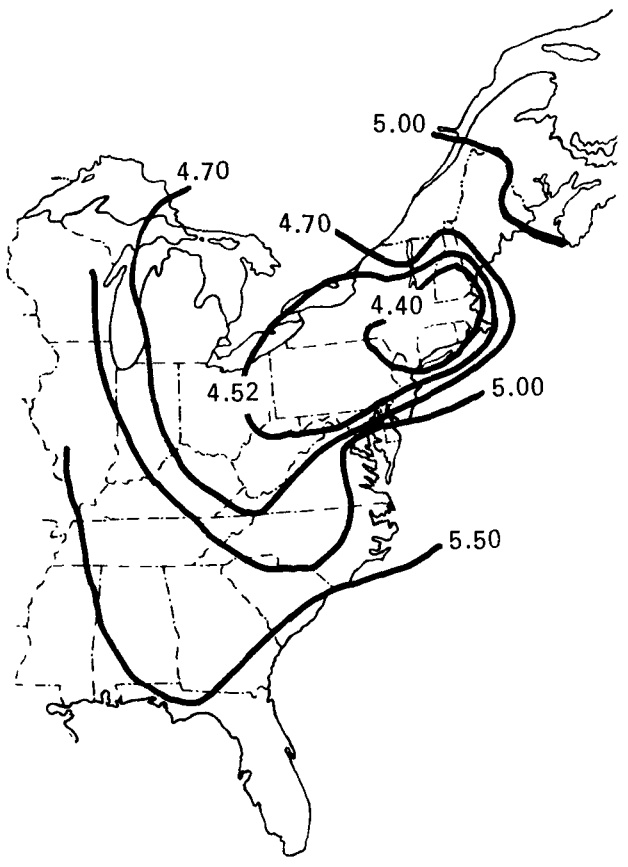


FIGURE 5. Predicated pH of precipitation over the Eastern United States, 1965-1966.

subdivisions and housing projects. EPA's responsibility in the non-point source management effort will be to provide guidance to the states for initiating planning and implementation of non-point source management in order that the 1983 water quality goals of PL 92-500 may be reached.

The basic elements of the non-point source planning and management process in the preceding areas will generally be the following:

1. In States where little or no evaluation of non-point source problems has been accomplished, an initial assessment of the nature and extent of non-point sources carried out through the existing State water quality management process will be a necessary first step. States that have already completed this step and have begun to implement an NPS program will want to periodically reassess the nature of existing non-point sources and monitor to determine the success of control programs. States propose planning, and ultimately, management programs through their existing State Water Quality Management process and Section 106 program stragety.

2. Once a problem assessment has been completed, and NPS categories and subcategories have been established, priorities should be set among the NPS categories. It is expected that priorities will vary considerably from state to state depending on the nature of the NPS problems, the progress individual States may have already achieved in certain areas, and available resources. A State may choose to deal with one category at a time or several simultaneously. In any case, the State sets highest priority on those categories where most water quality improvement can be accomplished immediately and selects to do those first, adding additional categories as rapidly as resources permit.

3. Once priorities have been established, the State drafts the definition of a significant non-point source for those NPS categories receiving consideration and proceeds to develop inventories of all significant sources within those categories.

4. The state then defines its own BMP's for the selected NOS categories and develops regulatory programs to implement the BMP's. Where necessary, a state will define its BMP's and BMP compliance schedules through new legislation and accompanying regulations.

5. In the planning and implementation of NPS management program, whether in designated or nondesignated areas, existing state, local, and Federal institutions may be utilized to monitor streams and to provide technical assistance in the field. In those cases in which a State delegates actual planning, implementation, or enforcement responsibility to other state or local agencies, the State will be responsible for the effectiveness and coordination of such arrangements, as well as the consistency of the management plans prepared within the state.

Successful implementation of the NPS program will require effective integration of the expertise and resources of other Federal agencies, including the Soil Conservation Service, U.S. Forest Service, U.S. Bureau of Land Management, Department of Transportation and Department of Housing and Urban Development.

THIRD NATIONAL CONFERENCE ON INDIVIDUAL ONSITE WASTEWATER SYSTEMS

Technology Trasnfer is co-sponsoring, with the National Sanitation Foundation, the Third National Conference on Individual Onsite Wastewater Systems. This year's conference is being held November 16, 17 and 18, 1976 in Ann Arbor, Michigan. The purpose of this series of annual conferences is to present a comprehensive state-of-the-art review of the efficiency of individual onsite wastewater systems, and develop recommendations for related current and future research activities.

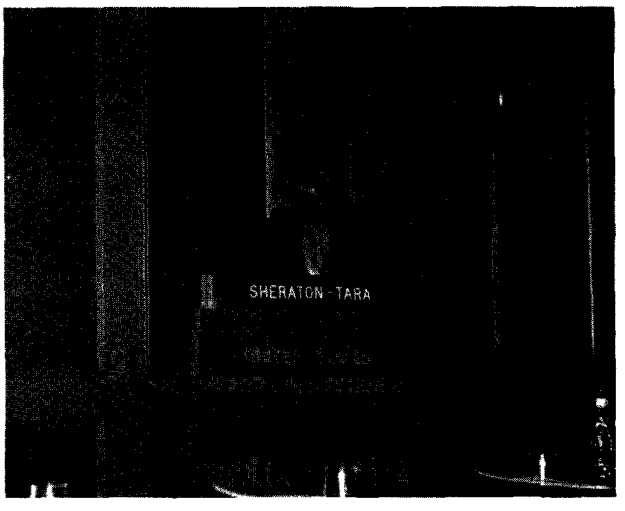
Additional information on this year's conference can be obtained from Dr. Nina McClelland, National Sanitation Foundation, NSF Building, Ann Arbor, Michigan, 48105 (Telephone 313-769-8010).

TECHNOLOGY TRANSFER SEMINARS ON GUIDANCE FOR IDENTIFYING AND ASSESSING POLLUTION FROM AGRICULTURE AND SILVICULTURE SOURCES

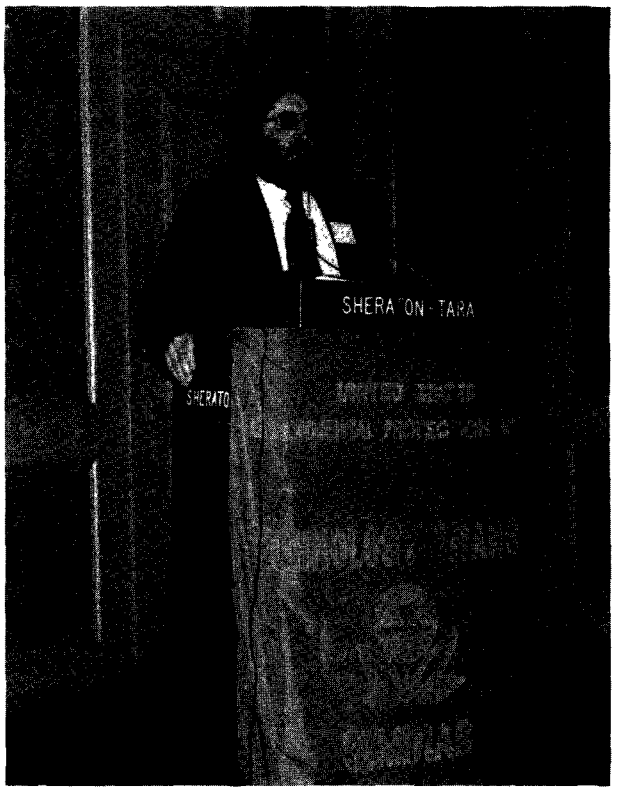
The first two in a series of Technology Transfer Seminars to assist statewide and areawide water quality management agencies in complying with Section 208 of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500) were recently held. The first seminar was held in Atlanta, Georgia, June 14-15; the second in Framingham, Mass., June 21-22, 1976. Approximately 130 public officials, and individuals from planning agencies, conservation groups, and agriculture and silviculture groups attended each seminar.

The intention of these seminars is to present draft guidance for identifying and assessing the extent of agriculturally and silviculturally related non-point sources of pollution to those parties most directly involved in the 208 process.

Essential to the development of meaningful final guidance was the feedback received from the seminar attendees both as regards the clearness and usefulness of the draft guidance and the identification of particular problems which involved in the 208 process have encountered. In order to facilitate this interchange of ideas, each seminar was divided into a discussion related to the proposed guidance system, consisting of formal presentations, question and answer periods, and workshops. Each attendee received a kit of information which was described in the formal sessions and used in the workshops. The major portion of each seminar addressed the particular problems identified by the attendees relating to non-point source identification and assessment.



Lester Suttion, Technology Transfer Chairman, Region I, welcoming attendies to Framingham, Mass. "208 Seminar".



Darwin Wright, EPA-Washington, D.C., addressing audience at Technology Transfer "208 Seminar" in Framingham, Mass.

Key presentations were made by: Harold Bernard, Environmental Quality Systems, Inc., Rockville, Md.; David Green and Robert Singer, U.S. EPA; Gordon Mellencamp, Chattanooga Area Regional Council of Governments; and Darwin Wright and Lee Mulkey, U.S. EPA Office of Research and Development, Washington, and Athens, Georgia, respectively.

For details about future seminars on this subject, contact the appropriate Technology Transfer Chairman listed in the back of this newsletter.

CONFERENCE ON "PLANNING ALTERNATIVES FOR MUNICIPAL WATER SYSTEMS'

Technology Transfer, in collaboration with the Holcomb Research Institute, Butler University, is co-sponsoring this conference, which is to be held October 10-14, 1976, at the French Lick Sheraton Hotel in French Lick, Indiana.

The conference is intended to bring together professionals with a broad range of backgrounds and responsibilities to discuss technological and policy issues in planning of municipal water systems. Invited speakers of national reputation, including Francis T. Mayo, Director, Municipal Environmental Research Laboratory, U.S. EPA, Dr. Beatrice Willard, Co-Chairperson, Council on Environmental Quality, and Lawrence K. Cecil, AIChE, will make presentations on the following:

*** Water Planning
*** Water Quality
*** Water Quantity
*** Management Alternatives
    Pricing
    Publicity
    Improved Efficiency
    Reuse
*** Public Acceptance of Alternatives

Although technical matters will necessarily be discussed, the conference is intended to promote the exchange of ideas among various disciplines, including law, economics, environmental and chemical engineering, planning and public administration.

For further information, write or telephone:
David Holtz
Assistant Director
Holcomb Research Institute
Butler University
Indianapolis, IN 46208
317-283-9421

NEW INDUSTRIAL SEMINAR PUBLICATION AVAILABLE

The latest industrial seminar publication, prepared by JACA Corp. and entitled "'Choosing the Optimum Financial Strategies for Pollution Control Investments," has been printed and is now available for distribution.

This publication is intended to alert decision makers to the availability of and qualifications for some of the financing incentives from federal, state, and local governments, and to demonstrate that it is well worth spending time analyzing the special methods of financing pollution control expenditures and the available tax treatments. Obtaining optimum financial and tax benefits could save a company tens of thousands of dollars over the life of the equipment.

This publication shows the businessman the type of financial analysis that should be accorded any type of pollution control expenditure in an effort to substantially reduce funds expended and to smooth out what could develop into a cash flow trauma. It also contains a discussion of the tax and financing positions of three hypothetical firms with different management goals but with similar capital expenditures for pollution control.

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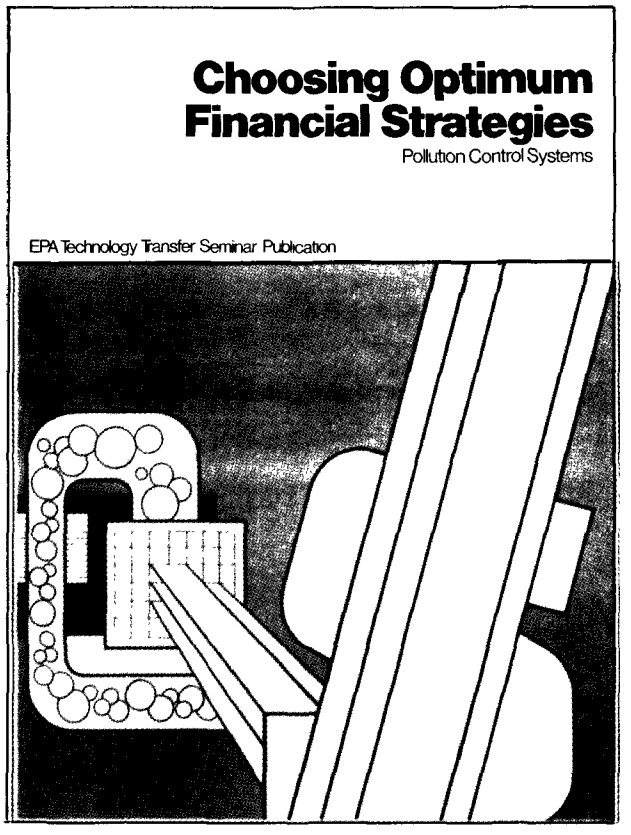

NEW TECHNOLOGY TRANSFER SEMINAR PUBLICATION ON EROSION AND SEDIMENT CONTROL FROM SURFACE MINING

A new Technology Transfer publication, entitled "Erosion and Sediment Control from Surface Mining in the Eastern United States," will be distributed for the first time at the "NCA/BCR Coal Conference and Expo III" meeting being held October 19-21, 1976 in Louisville, Kentucky. An anticipated 3500 persons representing government, academia, and industry are expected to attend this meeting.

This new publication presents an evaluation of the effectiveness of sediment ponds in reducing suspended solids in the runoff from surface mining activities. Nine selected sedimentation ponds in the three eastern coal-mining States of Pennsylvania, West Virginia, and Kentucky were sampled under two different operating

conditions, a baseline and rainfall event. Their theoretical and actual efficiencies of removal of suspended solids were computed and compared.

This publication can also be obtained by using the order form at the back of this newsletter.

WORKSHOP ON "CHLORINE DIOXIDE/OZONE OXIDATION PRODUCTS OF ORGANIC MATERIALS"

Technology Transfer, in cooperation with EPA's Office of Water Supply and the International Ozone Institute, is co-sponsoring a workshop on the subject of chlorine dioxide/ozone oxidation products or organic materials. This workshop will be held at the Stouffer's Cincinnati Towers, Cincinnati, Ohio, November 17-19, 1976.

The workshop will bring together those working in the field to discuss the current state-of-the-art and to determine what is known and what is not known about this subject. The objectives are to ascertain what work has been done, what work is being done, by whom and where, what compounds are being sought and/or studied, what analytical methods are being used and what toxicological studies are being made.

Current interest in the use of chlorine dioxide as a means of reducing formation of halomethanes in water, leads us to include a session on this oxidant material, which is being used today, sometimes in conjunction with ozone and activated carbon.

Presentations will be made by speakers of national and international reputation, including: Victor Kimm and Dr. James Symons, U.S. EPA; Yves Richard and Dr. Harteman, France; and Dr. E. Gilbert, W. Kuhn, and Dr. H. Sontheimer, Karlsbruke, Germany. After the presentations have been made, a round table, open discussion will be held to define current information gaps.

For more information, contact either D. J.A. Cotruvo, U.S. EPA, Office of Water Supply, Washington, D.C. (202-755-2884) or Dr. Rip Rice, International Ozone Institute, Washington, D.C. (202-296-8375).

EPA FORMS URBAN PLANNING TASK FORCE

EPA's Office of Research and Development has recently formed a six-member Urban Planning Task Force within its Municipal Environmental Research Laboratory in Cincinnati.

The primary responsibility of these technical specialists is to provide a focal point within EPA's Office of Air, Land and Water Use to coordinate activities and provide assistance and technological support to the agency's 208 program.

Directed by Mr. John M. Smith, this task force acts as liaison between EPA's OALWU research program and the operating programs responsible for implementing Section 208 of PL 92-500. The immediate efforts of the task force are devoted to summarizing and accelerating the delivery of pertinent research results to the designated 208 agencies and related user communities.

The task force has recently conducted a two-month intensive survey of 208 planning needs which included site visits or telephone interviews with 25 designated 208 agencies, discussions and meetings with EPA Regional 208 coordinators, 208 contractors, and other Agency personnel. An interim needs survey report summarizing the findings of the survey has been completed.

As a result of this survey, along with a complete review of the OALWU related research programs, the task force has undertaken the preparation of an "Areawide Assessment Procedures Manual" (AAPM) which will provide the most critically needed technological guidance for areawide planners in a readily usable form. The AAPM will contain seven chapters including data base inventory and problem identification, procedures for urban and non-urban pollutant source and load assessment, analysis of stream impacts, and evaluation and selection of control alternatives. In addition to this information, the AAPM will also contain eight separate appendices including a model applicability summary, land use data collection and analysis, monitoring requirements, best management practices, and a major appendix summarizing structural cost information and methods of analysis. The AAPM will be published in three separate volumes, each being in a ring binder. Portions of the first two volumes will have been published by August 13 and the third volume will be published by December 15, 1976.

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 your EPA Regional Technology Transfer Committee Chairman from the list below:

REGION	CHAIRMAN	ADDRESS
I	Lester Sutton	Environmental Protection Agency John F. Kennedy Federal Building Room 2304 Boston, Massachusetts 02203 617 223-2226 (Maine, N.H., Vt., Mass , R.I., Conn.)
II	Robert Olson	Environmental Protection Agency 26 Federal Plaza New York, New York 10017 212 264-1867 (N.Y., N.J., P.R., V.I.)
III	Albert Montague	Environmental Protection Agency 6th & Walnut Streets Philadelphia, Pennsylvania 19106 215 597-9856 (Pa., W. Va., Md., Del., D.C., Va.)
IV	Asa B. Foster, Jr.	Environmental Protection Agency Suite 300 1421 Peachtree Street, N.E. Atlanta, Georgia 30309 404 526-3454 (N.C , S.C., Ky., Tenn., Ga., Ala., Miss., Fla.)
V	Clifford Risley	Environmental Protection Agency 230 S. Dearborn St. Chicago, Illinois 60604 312 353-8880 (Mich., Wis., Minn., Ill., Ind., Ohio)
VI	Mildred Smith	Environmental Protection Agency 1600 Patterson Street, Suite 1100 Dallas, Texas 75201 214 749-1885 (Texas, Okla., Ark., La., N. Mex.)
VII	John Coakley	Environmental Protection Agency 1735 Baltimore Avenue Kansas City, Missouri 64108 816 374-5971 (Kansas, Nebr., Iowa, Mo.)
VIII	Elmer Chenault	Environmental Protection Agency 1860 Lincoln Street Denver, Colorado 80203 303 837-4343 (Colo., Mont., Wyo., Utah, N.D.) S.D.)
IX	William Bishop	Environmental Protection Agency 100 California Street San Francisco, Calif. 94111 415 556-6925 (Calif., Ariz., Nev., Hawaii)
X	John Osborn	Environmental Protection Agency 1200 6th Avenue Seattle, Washington 98101 206 442-1296 (Wash., Ore., Idaho, Alaska)

For the following audio-visual material, please contact your Regional Transfer Chairman. (See above)

MOTION PICTURES (16mm sound)

- Richardson, Texas Project—Title: "Somebody around here must be doing something good," (15 min.)
- *Phosphorus Removal* (5 min.)
- Water Quality Management, Alameda Creek, Calif.—Title: "The Water Plan." (28½ min.)
- *The Seattle METRO Story.* (28 min.)
- "Breakthrough at Clear Lake" (28 min.)

VIDEOTAPES

- Carbon Adsorption. (40 min.)
- Upgrading Activated Sludge Treatment Plants. (40 min.)

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Please send me the following publications at no charge. (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 ☐

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- Recycling Zinc in Viscose Rayon Plants . . . . . .2001 ☐
- Color Removal from Kraft Pulping Effluent by Lime Addition . . . . . .2002 ☐
- Pollution Abatement in a Copper Wire Mill . . . . . .2003 ☐
- First Interim Report on EPA Alkail SO_2 Scrubbing Test Facility . . . . . .2004 ☐
- Dry Caustic Peeling of Peaches . . . . . .2005 ☐
- Pollution Abatement in a Brewing Facility . . . . . .2006 ☐
- SO_2 Scrubbing and Sulfuric Acid Production Via Magnesia Scrubbing . . . . . .2007 ☐
- Second Interim Report on EPA Alkali Scrubbing Test Facility . . . . . .2008 ☐
- Magnesium Carbonate Process for Water Treatment . . . . . .2009 ☐

INDUSTRIAL SEMINAR PUBLICATIONS

- Upgrading Poulty 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 Investments . . .3005 ☐
- Erosion and Sediment Control from Surface Mining . . . . . .3006 ☐

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- Physical-Chemical Treatment . . . . . .4002 ☐
- Nitrification/Denitrification . . . . . .4004 ☐
- Upgrading Existing Wastewater Treatment Facilities—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 ☐

BROCHURES

- Seattle, Washington METRO . . . . . 5007 ☐
- Wastewater Purification at Lake Tahoe . . . . . .5008 ☐
- Indian Creek Reservoir . . . . . .5009 ☐
- Richardson, Texas . . . . . .5010 ☐
- Logging Roads and Water Quality . . . . . .5011 ☐
- Municipal Wasterwater Alternatives . . . . . .5012 ☐

HANDBOOKS

- Analytical Quality Control in Water and Wastewater Laboratories (1972) . . . . . .6001 ☐
- *Monitoring Industrial Wastewater* (1973) . . . . . .6002 ☐
- Methods for Chemical Analysis of Water and Wastes (Rev. 1976) . . . . . .6003 ☐

INDUSTRIAL ENVIRONMENTAL POLLUTION CONTROL

- Pulp and Paper Industry — Part I/Air . . . . . .7001 ☐

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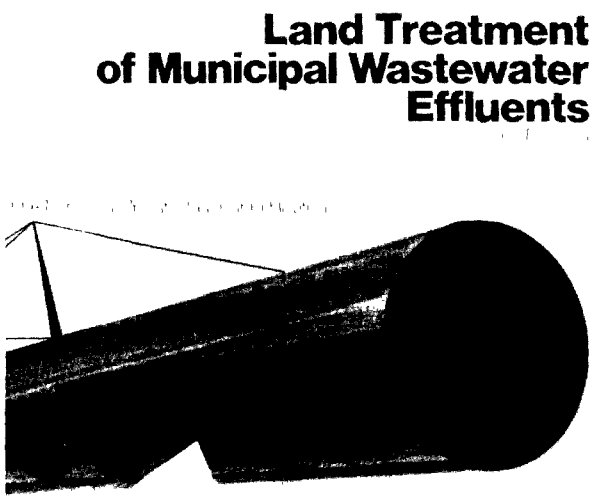
U.S. ENVIRONMENTAL PROTECTION AGENCY — MAY 1976

NEW MUNICIPAL SEMINAR PUBLICATION– "LAND TREATMENT OF MUNICIPAL WASTEWATER EFFLUENTS"

A new Technology Transfer municipal seminar publication has been printed and is now available for distribution. The publication, entitled "Land Treatment of Municipal Wastewater Effluents," consists of three separate volumes: Design Factors I, Design Factors II, and Case Histories. The information included in this publication was developed for the Technology Transfer Seminar Series on Land Treatment by Metcalf and Eddy Engineers, Palo Alto, California; CH_2M/Hill, Denver, Colorado; Culp, Wesner, and Culp, El Dorado Hills, California; and Michigan State University.

For your copy of this publication, use the order form at the back of this Newsletter.



"LOGGING ROADS AND WATER QUALITY" LATEST TECHNOLOGY TRANSFER BROCHURE

A brochure discussing practices of minimizing water quality impact due to logging road activity is now available from Technology Transfer. This publication was prepared by EPA's Region X, Seattle, Washington, and addresses good and bad management practices pertaining to logging roads. There are over 250,000 miles of logging

roads just in the Pacific Northwest and an additional 12,000 miles per year of these roads are being constructed or reconstructed.

This publication can be obtained by checking off the appropriate box on the order form in the back of this Newsletter.

WATER REUSE CONFERENCE

Technology Transfer, in cooperation with the American Institute of Chemical Engineers, is cosponsoring the Third National Conference on Complete Water Reuse to be held June 27-30, 1976, at the Netherland Hilton Hotel in Cincinnati, Ohio. The theme of this year's Conference is: "Symbiosis as a Means of Abatement for Multi-Media Pollution."

Symbiosis is the association of two or more dissimilar entities when such an association is mutually beneficial. An example of a simplistic symbiotic approach would be the use of a process wastewater effluent, either with or without treatment, as the influent to another wastewater-producing process. In this situation, the symbiotic approach would reduce the total process raw water demand and the possible requirement to treat two process wastewater effluents. The economics of control could be greatly modified by this approach.

For further details on paper write or telephone:

Lawrence K. Cecil
Consulting Chemical Engineer
418 Lincoln Building
44 Main Street, Champaign, IL 61820
217-356-8258

REVISED PHOSPHORUS REMOVAL DESIGN MANUAL AVAILABLE

The Technology Transfer Process Design Manual for Phosphorus Removal, originally prepared by Black and Veatch Consulting Engineers and published in October 1971, has been revised and is now available.

This revision was prepared in order to incorporate information on newly developed and demonstrated techniques and to include subsequent experience gained and data produced on those methods covered in the initial edition of this manual. In addition, a description of an EPA computer model for evaluating 22 alternative phosphorus removal strategies is included as an appendix to the manual. This model reports to the user the total cost of a selected strategy for removing phosphorus. The contractor used in completing this revision was Shimek, Roming, Jacobs and Finklea of Dallas, Texas.

If you have already requested the revised edition of this manual, it will automatically be forwarded to you. If you have not so requested, and desire a copy, please use the order form opposite this page.

NEW INDUSTRIAL SEMINAR PUBLICATION AVAILABLE

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A separate financial analysis is presented specifically for firms which have a choice of wastewater treated onsite or by a municipality.

For your copy of this publication use the order form opposite this page.

PROCESS DESIGN MANUAL FOR SUSPENDED SOLIDS REMOVAL (January 1975 Edition)

The following change should be made in the Process Design Manual for Suspended Solids Removal:

- Table 5-2, page 5-15. The second reaction should read: $Al_2(SO_4)_3 + 3Na_2CO_3 + 3H_2O \rightarrow 2Al(OH)_3 \downarrow + 3Na_2SO_4 + 3CO_2 \uparrow$

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- ☐ Sludge Treatment and Disposal (Oct. 1974) 1006
- ☐ Nitrogen Control (Oct. 1975) 1007

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- ☐ 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 Strategy for Pollution Control Investments 3005

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U.S. ENVIRONMENTAL PROTECTION AGENCY — JANUARY 1976

RELOCATION OF OFFICE OF TECHNOLOGY TRANSFER

ON November 3, 1975, the EPA Technology Transfer Program was physically relocated from Washington, D.C., to Cincinnati, Ohio. This relocation involves no changes in the functions or responsibilities of the program, and all Technology Transfer activities (seminars, publications, etc.) will continue as in the past.

All correspondence directed to Technology Transfer should be forwarded to:

U.S. Environmental Protection Agency
Technology Transfer
Cincinnati, Ohio 45268

Individuals on the Technology Transfer staff can be reached at 513-684-4404.

An up-to-date request sheet for Technology Transfer publications is attached for your convenience. Note that six semitechnical brochures (No. 5001 through 5006) have been deleted from this request sheet. A new publication has been developed to replace all of these six documents and will be available very shortly. Information contained in this one publication will be the latest available on all viable alternative wastewater treatment systems. As with the six publications being replaced, this publication is intended for use by other than design-oriented personnel and is also written in a semitechnical tone. Those of you who have requested any one of publications 5001-5006 will automatically receive the new publication when it becomes available.

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The publications listed on this form are the only ones available through the Office of Technology Transfer.

Please send me the following publications at no charge. (Check appropriate boxes)

PROCESS DESIGN MANUALS

- ☐ Phosphorus Removal (Oct. 1971) 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

TECHNICAL CAPSULE REPORTS

- ☐ Recycling Zinc in Viscose Rayon Plants 2001
- ☐ Color Removal from Kraft Pulping Effluent by Lime Addition 2002
- ☐ Pollution Abatement in a Copper Wire Mill 2003
- ☐ First Interim Report on EPA Alkali SO_2 Scrubbing Test Facility 2004
- ☐ Dry Caustic Peeling of Peaches 2005
- ☐ Pollution Abatement in a Brewing Facility 2006
- ☐ SO_2 Scrubbing and Sulfuric Acid Production Via Magnesia Scrubbing 2007
- ☐ Second Interim Report on EPA Alkali Scrubbing Test Facility 2008
- ☐ Magnesium Carbonate Process for Water Treatment 2009

HANDBOOKS

- ☐ Analytical Quality Control in Water and Wastewater Laboratories 6001
- ☐ Monitoring Industrial Wastewater 6002
- ☐ Methods for Chemical Analysis of Water and Wastes 6003

MUNICIPAL SEMINAR PUBLICATIONS

- ☐ Upgrading Lagoons 4001
- ☐ Physical-Chemical Treatment 4002
- ☐ Oxygen Activated Sludge 4003
- ☐ Nitrification/Denitrification 4004
- ☐ Upgrading Existing Wastewater Treatment Facilities—Case Histories 4005
- ☐ Flow Equalization 4006
- ☐ Wastewater Filtration 4007
- ☐ Physical-Chemical Nitrogen Removal 4008
- ☐ Air Pollution Aspects of Sludge Incineration 4009

BROCHURES

- ☐ Seattle, Washington METRO 5007
- ☐ Wastewater Purification at Lake Tahoe 5008
- ☐ Indian Creek Reservoir 5009
- ☐ Richardson, Texas 5010

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

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INFILTRATION/INFLOW SEMINARS

Technology Transfer recently completed a seminar series covering the subject of excessive infiltration/inflow in sewer systems. The seminars addressed the EPA Regulations and Guidelines and covered in depth an acceptable method for an analysis and survey of the collection system that will meet the EPA requirements. Seminars were held in each Region with total attendance approaching 3,000. Seminar locations were St. Charles, Ill.; Dallas, Texas; Atlanta, Ga.; Philadelphia, Penna.; Seattle, Wash.; San Francisco, Calif.; Kansas City, Mo.; New York, N.Y.; Denver, Colo.; and Boston, Mass. Feature presentations were made by Leland Gottstein and Robert Pfefferle of American Consulting Services, Minneapolis, Minn., and John Smith, National Environmental Research Center, EPA, Cincinnati, Ohio. Presentations on EPA Regulations and Guidelines were conducted by Charles Swanson, Charles Sutfin, and Haig Farmer of the Office of Air and Water Programs, EPA, Washington, D.C.

Sessions presented included: Impact of New Water Bill on the Construction Grants Program, Effects of Infiltration on Treatment Efficiencies, EPA Regulations and Guidelines, the Infiltration/Inflow Analysis and the Sewer System Evaluation Survey.

The impact of these seminars should facilitate a more coordinated flow of construction grants projects with the regulations in effect.

MUNICIPAL DESIGN SEMINARS

The Technology Transfer Program has conducted two additional municipal design seminars since March, 1973, bringing the total number of municipal design seminars conducted to 21. The most recent seminars presented were in St. Charles, (Chicago) Illinois, March 26 and Atlanta, Georgia, May 8-10.

The St. Charles Seminar was a one-day session on Storm and Combined Sewers held in conjunction with the Region V, Infiltration/Inflow Seminar. Francis T. Mayo, Regional Administrator, Region V, gave the opening welcome to the consulting engineers, regulatory personnel and other professionals in attendance.

The Storm and Combined Sewer Session included presentations on introduction and state-of-the-art; regulators; microstraining and disinfection; screening, dissolved air flotation; and three case histories—Detroit, Michigan; Kenosha, Wisconsin; and Milwaukee, Wisconsin.

The Atlanta Seminar included sessions on physical-chemical treatment, upgrading existing wastewater treatment facilities, and nitrogen con-

Leland Gottstein, President, American Consulting Services at Infiltration/Inflow Seminar.

Cliff Risley—Region V Technology Transfer Chairman speaking at seminar.

trol. Mr. Asa B. Foster, Jr., Director, Categorical Programs Division—EPA, Region IV, gave the opening welcome to the 100-plus consultants and regulatory personnel in attendance. The Federal Water Pollution Control Act—Amendments of 1972, was discussed by Andrew Robert Greene, Assistant Regional Counsel, EPA, Region IV.

Feature presentations at the above design seminars were given by Dr. Clair Sawyer; Dr. Denny Parker, Brown and Caldwell, Consulting Engineers; Dr. Richard Woodward, Camp, Dresser & McKee, Consulting Engineers; Richard Sullivan, American Public Works Association; and Mr. Robert Skrenener, Detroit, Michigan. EPA personnel participating in the seminars included Mr. Edwin Barth, Mr. Jesse Cohen, and Mr. John Smith from the National Environmental Research Center in Cincinnati; and Mr. Frank Condon from the Office of Research and Monitoring in Washington, D.C.

TECHNOLOGY TRANSFER SEMINAR PUBLICATIONS

Technology Transfer will distribute selected Seminar Publications at the 1973 Water Pollution Control Federation Conference in Cleveland, Ohio, on September 30-October 5, 1973. The publications will be featured in the EPA Technology Transfer Exhibit for the WPCF Conference. The specific publications are Nitrification & Denitrification Facilities, Physical-Chemical Wastewater Treatment Plant Design, Upgrading Lagoons, Design Criteria and Operating Experience for High Purity Oxygen Systems, and Upgrading Existing Wastewater Treatment Facilities—Case Histories.

These publications have been used extensively in the Technology Transfer Design Seminar Series and will be the first issues in the Municipal Design Seminar Publication Series.

Publications from the Technology Transfer industrial seminars series are now available for the Poultry Processing and Metal Finishing Industries. These publications include "In-Process Pollution Abatement", "Pretreatment of Poultry Processing Wastes", and "Waste Treatment" for poultry processes and "In-Process Pollution Abatement" and "Waste Treatment" for metal finishers. These publications can be ordered by checking the appropriate box in the Request Form at the end of this newsletter.

MANUAL FOR DESIGN OF WASTEWATER TREATMENT FACILITIES FOR SMALL MUNICIPALITIES

Technology Transfer has recently contracted for preparation of a Manual for Design of Wastewater Treatment Facilities for Small Municipalities. Completion is expected by mid-1974.

This Manual will generally include information required for the design of new wastewater treatment facilities of two million gallons per day and under. Major emphasis will be on the design of treatment plants for municipalities with populations of 10,000 or less which would normally correspond to design capacities of one million gallons per day and under. The Design Manual will include the necessary criteria, parameters, and other information required to design: 1) small treatment facilities that will meet secondary treatment requirements consistently without overly sophisticated operation and maintenance, and 2) small treatment facilities that will provide advanced wastewater treatment such as high degrees of removal of BOD, COD, nutrients, solids and other pollutants.

UPDATING OF PROCESS DESIGN MANUALS

Revisions to the four original Technology Transfer Process Design Manuals (Suspended Solids Removal, Carbon Adsorption, Phosphorus Removal, and Upgrading Existing Wastewater Treatment Plants) are approaching completion and will be available in the very near future.

The purpose of revising these manuals—originally issued in October 1971—was to incorporate information on newly developed and demonstrated techniques and to include any subsequent experience gained and data produced on those methods covered in the initial edition of the manuals.

For those individuals who have the original manuals and have not yet requested the manual revisions, it is essential this be done as soon as possible. This can be accomplished by either forwarding the request card contained in the back of each manual, or by sending a letter to Technology Transfer, U. S. Environmental Protection Agency, Washington, D.C. 20460.

NEW TECHNOLOGY TRANSFER PROCESS DESIGN MANUAL FOR SLUDGE HANDLING AND DISPOSAL

A contract for the development of a Technology Transfer Design Manual for Sludge Handling and Disposal has been awarded to Black, Crow and Eidsness of Gainesville, Florida. Scheduled completion of this manual is mid-1974.

Detailed information, including design criteria and cost estimates, will be included for all feasible alternative designs for the various sludge handling, processing, and disposal processes. Information, criteria, estimates, and case histories will be included for both new and existing wastewater treatment facilities and the "how-to" design aspects will receive major emphasis.

CONTROL OF POLLUTION FROM METAL FINISHING FACILITIES*

Metal finishing operations involve a variety of processes for improving or conditioning surfaces. These include cleaning, pickling, annealing, case hardening, polishing, immersion plating, electroplating, phosphating, anodizing, and others. These processes generally change the surface of a product to improve corrosion resistance, impart greater hardness, increase wear resistance, improve the aesthetic appearance, or change the electrical conductivity of the surface.

Five types of pollutants are commonly associated with metal finishing operations. These are cyanides, metals, organics, dissolved solids, and extremes in alkalinity or acidity. Nearly all of these pollutants are potentially toxic or hazardous to living organisms at the strengths used in metal finishing operations.

SOURCES OF WASTE

The sources of waste from metal finishing facilities include normal process effluents from cleaning and de-scaling operations, pickling operations, plating operations, rinsing operations, and air scrubbing operations. These wastes are discharged on either a batch or continuous basis as well as accidental discharges of process solutions.

Cleaning and De-Scaling Operations

To obtain a good quality finish in a metal processing operation, whether it be an organic, metallic, or a chemical coating, it is imperative that the surface of the workpiece be completely free from oils, greases, rust, or other oxide films. This requires that cleaning operations be performed prior to chemical processing. Often, it is necessary to initially subject the workpieces to a mechanical operation, such as tumbling, blast cleaning, polishing, or buffing, prior to the chemical processing steps. These mechanical operations can produce an effluent which contains high levels of suspended solids.

Cleaning and de-scaling solutions remove oil, grease, scale, and surface metal film and hold the removed material without depositing it back on the workpieces being processed. The cleaners employed are usually alkali phosphates and relatively high concentrations of wetting agents to provide fast and complete oil, grease, and soil removal. In time, the effectiveness of these cleaning and de-scaling agents diminishes until the solution must either be dumped as a batch discharge or continuously bled. The solvents used for degreasing, such as the nonflammable chlorinated hydrocarbons or the flammable solvents (kerosene), can form emulsions in water or a floating film which not only detracts from the appearance of the water but also presents danger to living organisms. In addition, these organic contaminants may be inflammable or liberate toxic gases which would also prohibit their discharge to a storm or sanitary sewer system. The biochemical oxygen demand in the effluent may be sufficiently high to require biological treatment.

Pickling Operations

In the pickling operation the wastes are discharged in the rinsing process or in the dumping of spent processing solution. The pickling solutions are usually strong acids. The acids are consumed by the dissolution of oxides and metals. The acid must then be replenished and metal ion content of the effluent from pickling may be high in copper, zinc, nickel, cadmium, iron or other heavy metals which are toxic to most living organisms and may have deleterious effects at low concentrations. In addition, exposure to acid water will cause damage to masonry and iron structures. Alkaline pickling solutions are used primarily for etching aluminum and zinc. These solutions are generally highly caustic and must be neutralized with acid or spent-acid-pickling solutions.

Plating Operations

Effluents from many of the alkaline plating solutions contain complex metal cyanides. Of the non-cyanide processing solutions the primary toxic constituent is the heavy metal ion. Chromium-containing chemicals are used in many plating solutions as well as etching, anodizing, electropolishing, and chromating solutions. The chromium ion content of many of these processing solutions is quite high and, consequently, the rinse effluents following processing are high in chromium ion whch is toxic even in dilute concentrations.

Rinsing Operations

Metal finishing requires large quantities of water to wash away the chemical film on the work surface. This rinsing minimizes the potential for formation of insoluble metal salts on the workpieces (which would preclude good adhesion at subsequent processing steps) and reduces the contamination of one process solution caused by the carryover of impurities or chemicals from a previous process. The rinse water effluent will carry dissolved solids resulting from the dragout (the solution carried out of the process tank during withdrawal of the workpiece) from numerous processes which con-

*Extracted from publications prepared for the Technology Transfer Seminar Series "Upgrading Metal Finishing Facilities to Reduce Pollution". For your copy of the complete publications, fill in the form at the end of this newsletter.

tain alkali cleaners, acids, pickling solutions and others. While the total dissolved salt concentration in the water may not have increased appreciably, the effluent carries the various metal salts, cleaning compounds, and possibly a small quantity of the oils and greases originally removed by the cleaners from the work surface.

Air Scrubbing Operations

Metal finishing operations create in general two types of air emissions: gaseous contaminants and entrained liquid. The gaseous contaminants are commonly HCl, HF and NO_2. Entrained liquid particles are released from plating baths due to air agitation, drippage, and mechanical agitation of the bath. The particles are generally 10 microns in size or larger. In order to remove these contaminants from the air, wet scrubbers are generally utilized. The scrubber water effluent will contain much of the soluble gas released from the process tanks and 99 percent or more of the entrained liquids from the process baths.

Accidental Discharges

Process solutions, containing concentrated toxic materials, accidently discharged in large volume to a stream or a sewer system could result in catastrophic damage to living organisms in the stream or a biological upset of the sewage treatment plant. For this reason, the potential hazard connected with accidental discharges of process solutions is significant.

In-Process Pollution Control

Before any decision is made regarding selection of waste treatment equipment, an intensive in-process effort must be made to minimize the quantities of pollutants and water discharged.

A plant survey should begin with the preparation of an accurate site plan to identify the location of all influent and effluent lines from the plant site, space available for future pollution control equipment, and the influence the site topography might have on drainage and future construction.

Next, information on the plant layout and operating characteristics should be studied. Special attention should be given to location of equipment within the processing cycles, the production rates for each cycle, the location of accessory equipment, plant electrical capacity, steam availability, head space and support column locations. Also, data on the volume of the tanks within each cycle, the quantities of chemicals used, the quantity of rinse water used, the volume of dragout, and the frequency of spent-process-solution discharges should be recorded at normal production levels.

Once the base-line data on plant operations has been collected, steps should be taken to reduce chemical wastes through the minimizing of chemical process substitution or through lowering process solution concentrations. Substitution of low-concentration solutions for those of high concentration can be accomplished in many instances with no compromise to product quality and with considerable reduction in waste loading to the treatment system. For example, low cyanide solutions can account for a reduction of up to 90 percent in the usage of cyanide. Tighter process control is generally required when these baths replace conventional cyanide processes. In conjunction with this reduction in cyanide, the use of chelates may be eliminated, thus minimizing the problem of removal of zinc from the waste stream. Other substitutions that can be made include non-phosphate cleaners, non-chromium dips in conversion coatings and anodizing, non-cyanide stripping solutions, non-chromium bactericides for cooling water, and non-cyanide gold and copper processes.

Most processes offer a range of concentrations in which they may be operated successfully. The industry has traditionally selected the midpoint in these ranges as the operating concentration. With effluent standards and cost savings in mind, serious consideration should be applied to operating the process solutions at their minimum concentration limits. As an example, a standard nickel plating solution has the following composition limits:

CHEMICAL	RANGE	OPERATING CONCENTRATION
nickel sulfate ($NiSO_4 \cdot 6H_2O$)	40 to 50 oz/gal	45 oz/gal
nickel chloride ($NiCl_2 \cdot 6H_2O$)	8 to 12 oz/gal	10 oz/gal
boric acid (H_3BO_3)	6.0 to 6.5 oz/gal	6.3 oz/gal

At the above operating concentrations, a typical small plating shop running an average of 12 hours per day and 250 days per year would experience an annual loss of nickel salts (due to dragout) of approximately 8500 pounds nickel sulfate and 1900 pounds nickel chloride (based on the processing of 600 square feet/hour and a conservative dragout rate of 1.5 gallon/1000 square feet). Had the minimum concentrations been used for the year, the resultant saving in nickel chloride would have amounted to $800. If this shop applied the same thinking to the other process solutions in the plating line, a major improvement in operating costs is readily obtainable. Not considered in the improvement is the potential cost savings in effluent treatment. All metal finishing operations merit this type of assessment. Reduction of solution concentration will require closer process control, however.

The losses of chemicals from a process tank can be reduced by minimizing the dragout. The major factors which influence the dragout are the velocity of the withdrawal of the workpieces, the geometry of the workpieces, the positioning of the pieces on the rack or fixture, the drainage time allowed over the process tank, the viscosity

and density of the process solution, and the temperature of the solution. Optimum conditions should be created in each of these areas to minimize dragout. Some examples of steps that may be effective in reducing dragout include slowing down the rate of withdrawal, increasing drainage time over the process tank, operating the bath at as high a temperature as possible, utilizing salts that will yield a high-density, low viscosity process solution.

Rinsing represents the most frequently used process in metal finishing. It is by far the largest consumer of water and has been often given little or no consideration as to cost or pollution problems. In plants where there has been little attention to rinse flow rates, water conservation studies have repeatedly shown that each rinse tank flow may usually be reduced by 50 percent without impairment of rinsing quality. In order to determine the minimum water requirements for rinsing, the rinse water flow must be reduced gradually until the residual chemical film in the rinse water, because of its concentration and thickness, begins to cause deterioration in the quality of the workpiece or the quality of the finish in succeeding processes. Once these minimum flow rates have been established, flow restrictor valves which provide for flows slightly above the minimum levels should be installed. For example, an average plant whose total flow rate is 100 gpm can save approximately 50 gpm. Based on 3000 operating hours per year and a water charge of $0.25/1000 gallons, an annual saving of over $2000 is achieved. The same reduction in water usage will cut the capital costs of a waste treatment system in half. For the average plant that saving can amount to $40,000.

Further and equally dramatic reductions in water consumption are achievable through the use of mechanical devices and equipment rearrangements such as counterflow multiple tank rinsing. In counterflow rinsing, used water exiting the first tank becomes feed water for the second, and, after being used again, feeds the third tank as shown in Figure 1.

The advantage of counterflow rinsing is in the repeated exposure of the workpieces to the water, the increase in dwell time, permitting more diffusion to occur, and the ability to bring the majority of the water passing through into more intimate contact with the work. The results in water saving are significant. For example, if a dragout of 1 gph in a given case required a 1000 to 1 dilution in order to produce acceptable work, 1000 gallons of rinse water per hour would be required in a single rinse tank; in a double counterflow rinse system, 30-35 gph are required, and in a triple counterflow rinse system, 8-12 gph are needed. The disadvantage is that the work requires two or three processing steps instead of one, and more equipment and space is normally required. If multiple counterflow rinsing is designed into prospective automatic metal finishing equipment, the initial disadvantages are increased capital expense and space requirements. The ultimate advantage, however, lies not only in the enormous drop in water costs, but also in a sharp reduction in the cost of the supporting waste treatment system.

Multiple tank rinsing, shown in Figure 2, is merely a battery of single rinses, each with its own feed waters. The principles are generally the same as in the counterflow rinsing system above, although the total reduction in water consumption will not be as great as with the counterflow system.

Spray rinsing is another method of effectively rinsing workpieces to reduce carryover of contaminants with minimum water usage. Two categories of spray rinsing may be used. The first, impact spraying, uses both impact and diffusion to remove contaminant films. It uses little water compared to immersion rinsing and may be used in some cases as a recovery rinse by pumping the collected spray volume into the previous process tank. Impact spraying is ineffective, however, when the workpieces have areas inaccessible to the spray nozzles.

The second method, rinse and spray, employs immersion rinsing followed by a spray, operational only when the work is withdrawn from the rinse tank. It is advantageous in removing stubborn films by impact and permits lower water flows in the main body of the rinse tank. These two spray methods are shown in Figure 3.

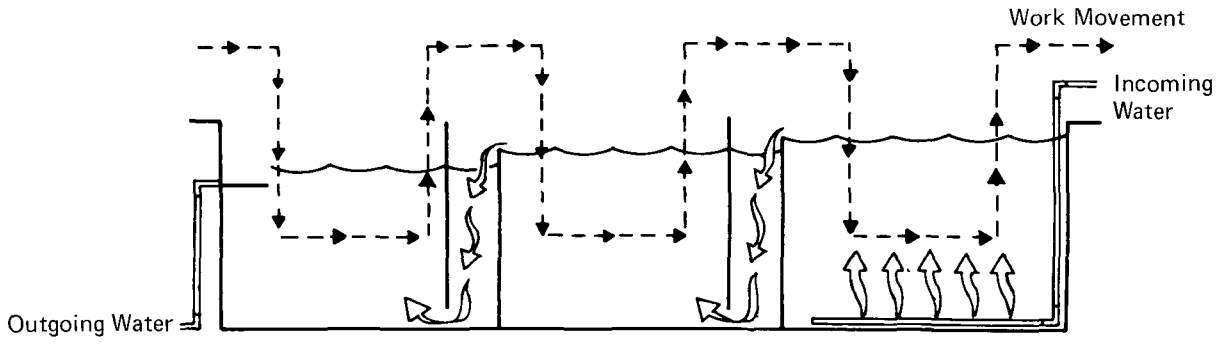


Figure 1. Triple Counterflow Rinse

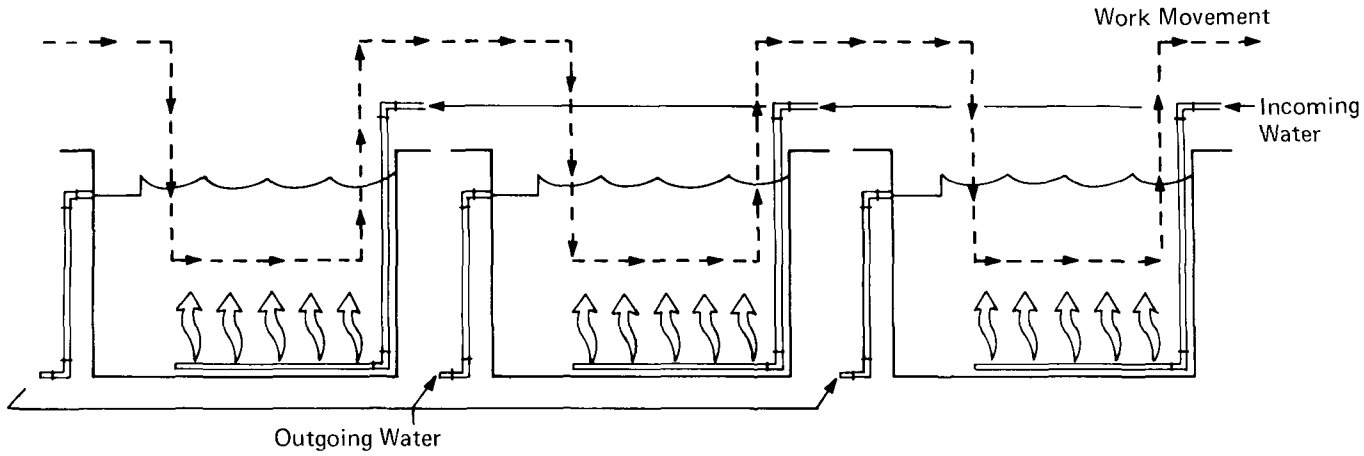


Figure 2. Multiple Tank Rinsing

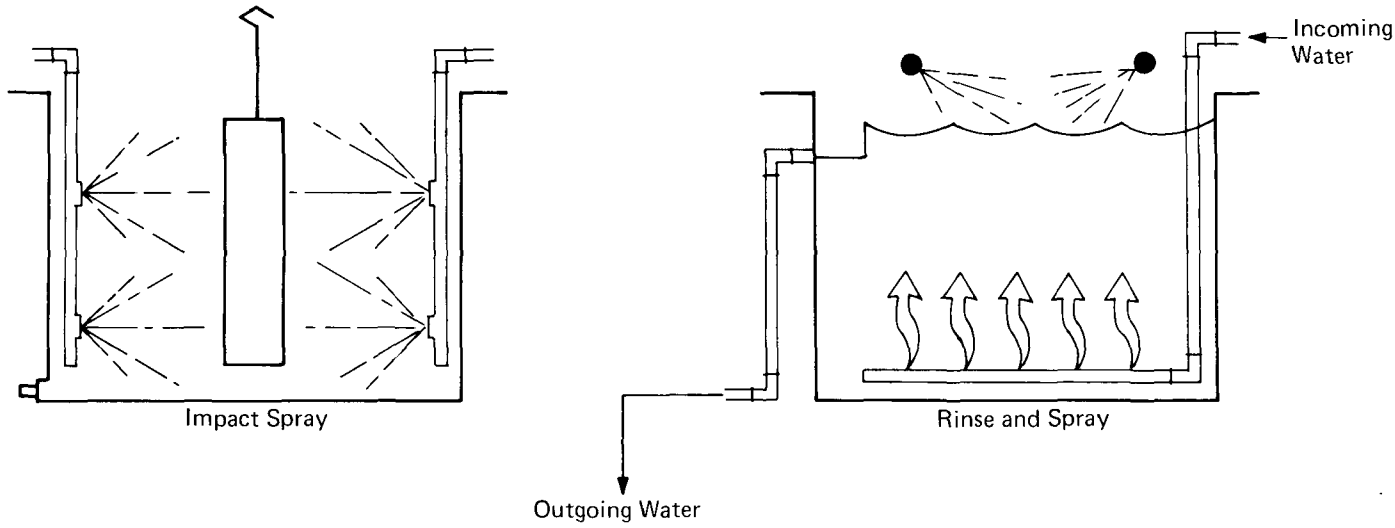


Figure 3. Spray Rinsing

WASTE TREATMENT

The three most commonly used methods of waste treatment are chemical conversion, precipitation and solids separation, and ion exchange.

Chemical Conversion

The chemical conversion method of treatment is widely used in the destruction of cyanide, the reduction of hexavalent chromium and in the conversion of soluble heavy metals to heavy metal hydroxides.

Cyanide is typically treated by adding caustic until the pH reaches 11.5 and then adding chlorine or sodium hypochlorite. This treatment converts the cyanide into cyanate. The cyanate can be further broken down into nitrogen and carbon dioxide by adjusting the pH to 7.5 to 8.0 and further addition of chlorine or sodium hypochlorite. Another method of cyanide treatment is the Kastone process developed by the DuPont Company. In this process the solution pH is adjusted to 10.0 to 11.5. The solution is heated to 120 to 130°F and hydrogen peroxide and formalin are added. This process is applicable to the treatment of sodium, potassium, zinc and cadmium cyanide only.

Hexavalent chromium is commonly treated by the addition of acid to reduce the pH to 3.0 or less and the addition of sodium metabisulfite, sodium bisulfite, ferrous sulfate, or sulfur dioxide gas. The above treatment reduces the hexavalent chromium to the trivalent state. The pH is then increased prior to separation of the solids precipitate.

Precipitation and Solids Separation

Metal salts are commonly removed from waste streams by adjusting the pH to the neutral range (pH 7.0 to 8.5) where many of these metal salts will become insoluble. Each metal salt has a specific pH at which its solubility is lowest. Therefore, to achieve optimum removal of each of the metal salts present, the waste streams should be segregated and individually treated.

This treatment of segregated waste streams provides the additional advantage of yielding a sludge which is high in concentration of each process metal. This concentrated sludge is much less costly to process for recovery of metals. When the waste streams are not segregated the best pH for the most complete separation will be the pH that will provide for the removal of the most toxic metals present. The sludge resulting from precipitation of metals from waste streams that are not segregated is relatively difficult and costly to process for metals recovery. The optimum pH levels for precipitation of metals at various concentrations are shown in Figure 4. In addition to natural precipitation of metal hydroxides, coagulants such as ferric sulfate, ferric chloride, or aluminum sulfate are used in the ranges of 100 to 300 milligrams per liter. The effectiveness of various concentrations of ferric sulfate on turbidity is shown in Figure 5.

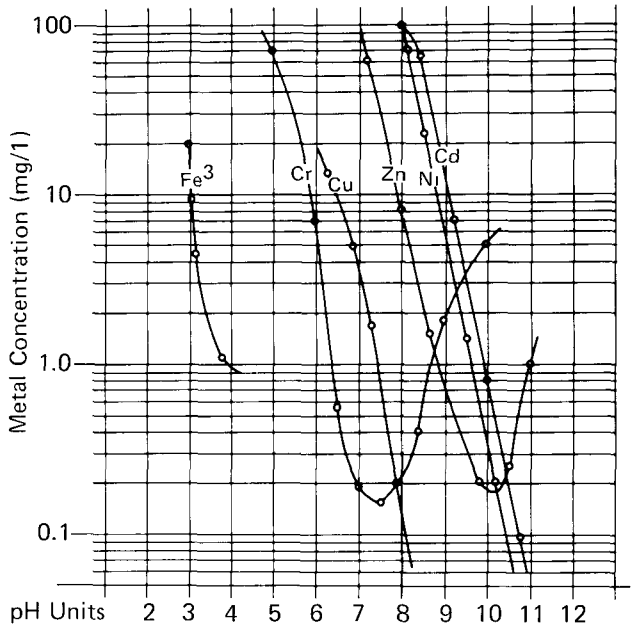


Figure 4. Precipitation of Metal Salts vs. pH

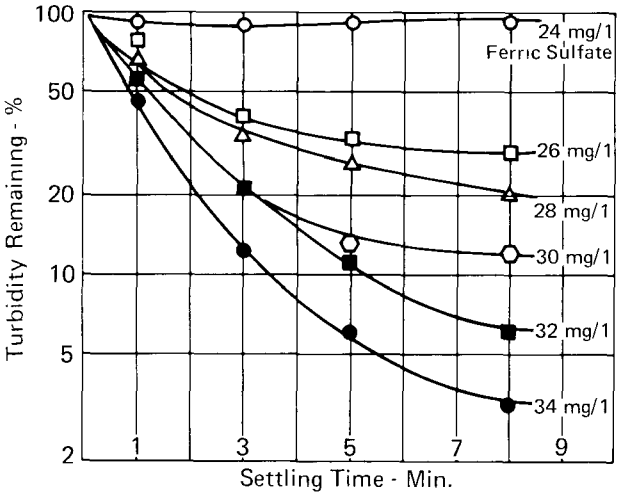


Figure 5. Coagulations and Settling Time vs. Concentration of Coagulant

Ion Exchange

Ion exchange is a method for concentrating the chemical contaminants from rinse waters so that they can be more economically treated or recovered. Basically, ion exchange removes an ion from the solution to be treated by exchanging it with a less harmful ion from the ion exchange resin. The process is cyclic. The solution being treated passes through the exchanger until the resin is exhausted. The resin is then regenerated to its original state by contact with a relatively strong solution of the ion originally on the resin. At this higher concentration the resin will pick up this ion and give up the ion originally recovered from the rinse water to the regenerating solution. The regenerating solution then becomes a relatively concentrated solution of the contaminant originally in the rinse water. This concentrated solution can be more easily treated or recovered. The original rinse solution being treated is now de-ionized water which can be reused in the process. The recovery of metals and process solutions for reuse through ion exchange and evaporation is discussed in a following section of this article.

From a mechanical point of view, there are two types of ion exchange systems in use: Fixed Bed, Moving Bed.

Fixed bed exchanger systems usually consist of at least two exchangers containing a fixed charge of resin. An exchanger is taken out of service as it nears exhaustion and put into the regeneration cycle. The solution being treated is switched to a resin bed which still has exchange capacity.

The moving bed exchanger, shown in Figure 6, enables resin rinsing, regeneration, and make up to be conducted in one exchanger which operates continuously on the solution side. Since each resin slug has less time in the exchange zone before backwash and regeneration than its fixed bed counterpart, it is less likely to become fouled. Moving bed exchangers usually find their application in the larger installations.

When an ion-exchange installation is used for the purification of rinse water effluent from several processes, the reclamation of the process chemicals contained in the backwash water usually cannot be returned to the original process from which they originated. In an installation of this type, the main function of the ion-exchange installation is to avoid waste treatment of large volumes of rinse water effluent backwashing since all the chemicals that require treatment become available in a far more concentrated form. Where the process waste streams have been segregated the function of the ion exchanger is to return nearly all the rinse water to the process for repeated usage and allow a simplified waste treatment with regard to the volume of the total waste to be treated. The chemical and maintenance cost of the ion-ex-

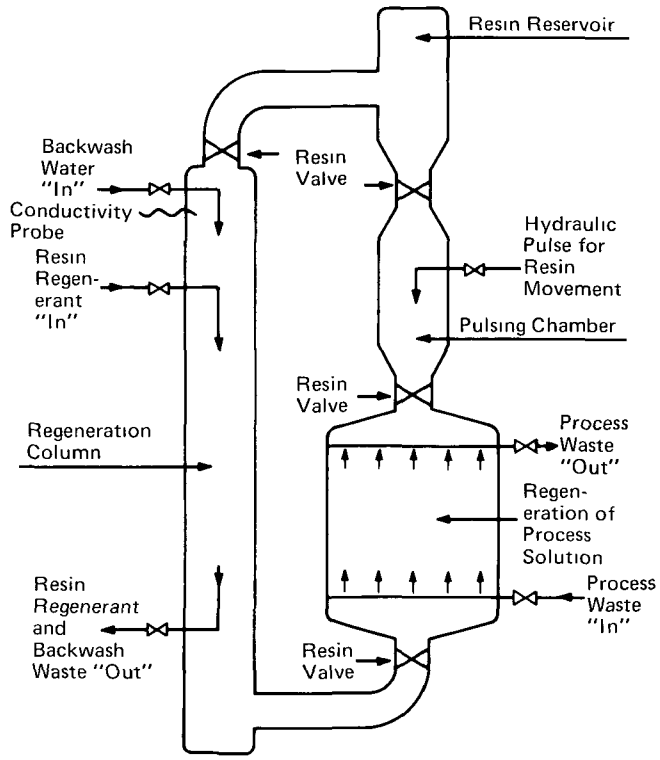


Figure 6. "Moving Bed" Ion Exchanger

change installation would have to be balanced against the water savings. Care must be taken to ensure that materials that foul the resins such as oil, organic brighteners, and wetting agents are removed in a carbon filter upstream of the ion exchanger. Also, it is important that precipitated metal salts and other suspended solids are removed from the waste stream prior to entering the ion exchanger. The ion-exchange unit should be sized so as to allow for a 20 to 25 percent drop in efficiency between backwashings.

Another approach to chemical treatment of wastes is the controlled circulation or "integrated waste treatment" system. The basic concept of this system is the segregation and treatment of the waste at its source. It employs a chemical cleaning bath to remove the contaminants carried over from the process tank, a treatment tank for addition of treatment chemicals, and a settling tank for precipitation of metal hydroxides (see Figure 7). The system is integrated into the process line. The chemical cleaning bath solution is continuously bled to the treatment tank, from there to the settling tank, and after solids separation, 80 to 90 percent of the liquid is pumped back to the chemical cleaning tank for reuse. The advantages of this system include relatively low capital cost for treatment equipment, dramatic reductions in water use, improved rinsing, relatively low chemical costs, segregation of metal sludges which are more economically recoverable. The disadvantages of the system include the need for additional rinse tanks and the need for tight operating limits on the quality of the chemical rinse solution.

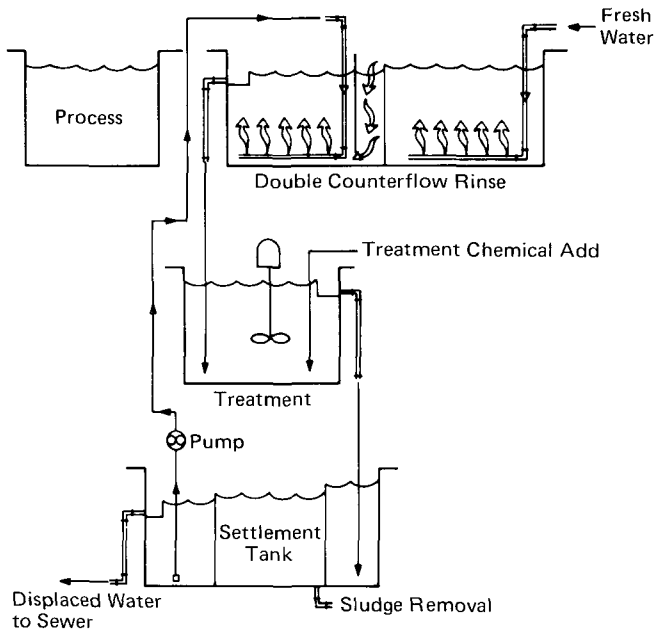


Figure 7. Controlled Recirculation

RECOVERY OF PROCESS SOLUTIONS AND METALS

The systems most commonly considered for recovery of process solution and metal are ion exchange, evaporative recovery, and reverse osmosis.

Ion Exchange

Ion exchange systems combined with evaporation have potentially wide applicability for the recovery of metal or the regeneration of process solutions as well as for the treatment uses discussed earlier. For example, when rinse waters from chromium plating are passed through a cation exchange column, the system may serve the function of recovering the valuable chromium chemicals by removing the impurities such as trivalent chromium, copper, zinc, nickel, and iron, in the cation exchange column, the backwash waters from which would otherwise go to waste treatment. An evaporation system allows further concentration of valuable chemicals and reuse of the rinse waters.

Ion exchange systems can also be used for the maintenance of process solution quality. Aluminum can be removed from a chromic acid anodizing bath, avoiding the necessity of periodic disposal of the bath. Chromic acid, as a strong oxidizer, will deteriorate the resin to some extent and, therefore, concentrated chromic acid solutions should first be diluted with water before regeneration through an ion exchanger is attempted.

Moving bed ion exchangers have been successfully utilized for process solution recovery such as bright dip solutions used for aluminum

which require resins to be able to accept high-strength oxidizing acids and have removal rates of large quantity of aluminum, maintaining the process solution at the optimum aluminum concentration.

Evaporative Recovery

There are basically two types of evaporative recovery systems commonly in use: the vacuum evaporator and the atmospheric evaporator. A vacuum evaporator operates at sub-atmospheric pressures, thus enabling evaporation to take place at temperatures in the range of 130 to 190°F. At these temperatures the oxidative breakdown of cyanide compounds is reduced. An atmospheric evaporator operates at atmospheric pressure and the normal boiling temperature of the solution being processed. These types of evaporators can be utilized in either open or closed loop processing cycles.

The open loop cycle is adaptable for partial recovery of plating chemicals on those plating installations where there is an insufficient number of countercurrent rinse tanks. A small portion of the chemical dragout that accumulates in the final rinse tank is not circulated to the evaporator for concentration. The circulation loop through the evaporator is opened by creating another flow path for the chemical dragout. This small fraction of dragout solution not returned to the evaporator can be treated by an appropriate chemical method before disposal.

The closed loop system is an effective way to recover cyanide, metal cyanides, chromium and other metal-containing chemicals from plating operations so that chemical treatment of rinse water is eliminated or minimized. This technique can be economically applied only to processing lines using countercurrent rinsing. In a typical system, Figure 8, a single-effect evaporator concentrates flow from the rinse water holding tank. The concentrated rinse solution is returned to the plating bath and the distilled water is returned to the final rinse tank.

In the closed loop system, no external rinse water is added for makeup except that required by atmospheric evaporation. The only chemicals added to the plating bath are those required for replacing what is actually deposited on parts and any spillage or accidental losses. The system is designed to recover 100 percent of the plating chemicals normally lost in dragout for reuse in the plating cycle.

Reverse Osmosis

Functionally, the reverse osmosis applications in metal finishing are very similar to the opportunities available by evaporation. Theoretically, reverse osmosis aims to apply high pressure to a suitable thin membrane, overcoming the osmotic pressure, passing water through the membrane which at the same time rejects the salt molecules and thereby separates a relatively salt-free water stream and a salt solution at a higher concentration than the original input was. Rinse waters from a specific process can thereby be treated, the water product returned for rinsing, and the concentrates, possibly after further concentration by evaporation, returned to the process. Suitable membrane materials for cyanide and chromium type rinse water reconcentration are not yet commercially available.

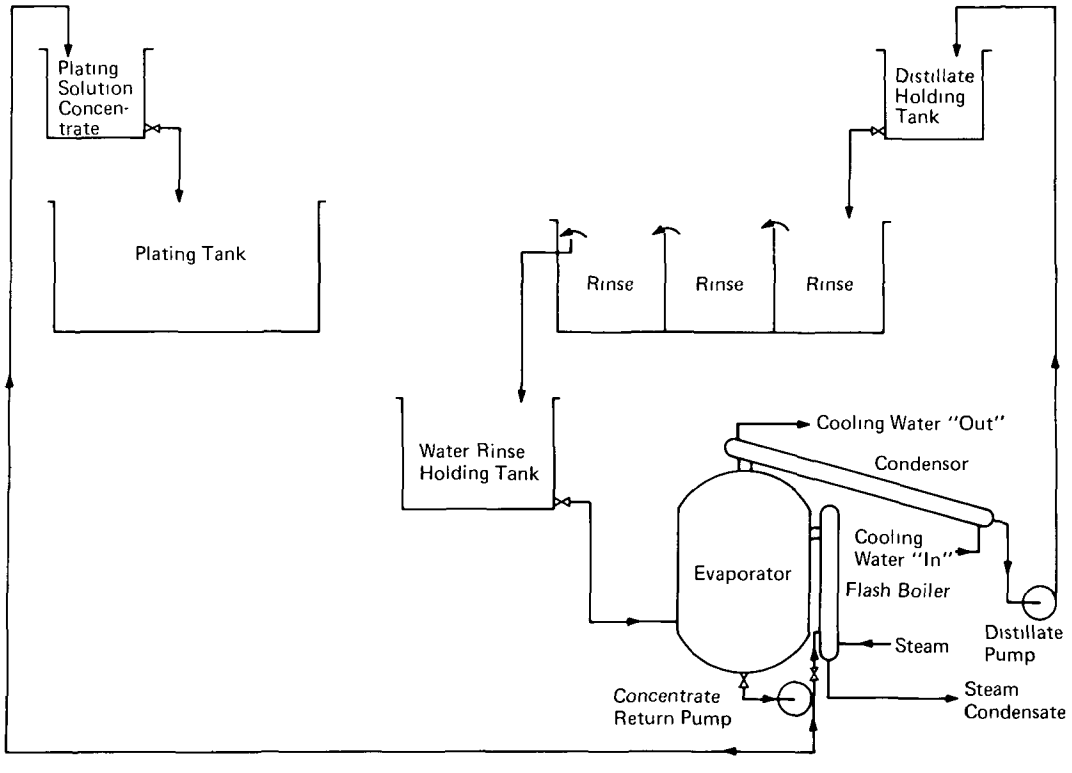


Figure 8. Evaporative Recovery—"Closed Loop"

POLLUTION CONTROL SEMINAR FOR THE DAIRY INDUSTRY

Technology Transfer held its first industrial seminar for the Dairy Industry, entitled "Upgrading Dairy Production Facilities to Control Pollution", in Madison, Wisconsin, on March 20 and 21, 1973. The program included in-depth coverage of the new water pollution control legislation as well as presentations on EPA enforcement policy by Linda Huff of the EPA Region V, National Discharge Elimination Program and on the State of Wisconsin's regulatory program by Thomas G. Frangos, Administrator of the Wisconsin Department of Natural Resources.

Three technical sessions were held covering in-plant management, waste treatment, and a session on whey. The in-plant session, conducted by Robert R. Zall of Cornell University, specifically covered waste characterization, waste measurement and monitoring, economic alternatives of waste reduction solutions, process variation to reduce waste, recovery and salvage of waste products, recycling of fluids, instrumentation, cleaning and sanitizing solutions, and reduction of product loss through operation and maintenance.

The session on waste treatment, presented by Kenneth Watson of Kraftco Corporation, George Muck of Dean Foods, Dr. William Boyle and Dr. L. B. Polkowski of Polkowski, Boyle and Associates, and Paul F. Hickman of the Springfield, Missouri, Department of Sanitary Services, covered treatment alternatives available for discharge of wastes to municipal treatment plants and to waterways. The discussion included the relative advantages of joint treatment of dairy wastes in municipal wastewater treatment plants, waste treatment alternatives, and case studies of actual pollution abatement efforts by dairy production facilities.

The session on whey consisted of a panel discussion of the recovery, utilization, and disposal of whey. The discussion covered current practice and new technology applicable to the utilization of whey.

A special luncheon featured a presentation by Fred J. Greiner, Chairman of the Dairy Industry Committee on Industry and Government Relations.

The final general session included a presentation by Charles Marshall of J. A. Commins and Associates, an industrial management consultant, on the optimization of financial strategy for pollution control investments. The discussion covered tax advantages, depreciation of equipment, government and private sources of financing available, and the economics of joint treatment with a municipality versus privately financed treatment facilities.

Also included in this session was a presentation by Kenneth Dostal of the EPA Pacific Northwest Water Laboratory, covering the status of the EPA Demonstration Grant Program.

This seminar is scheduled to be repeated on the East Coast (Region III) in August 1973.

FIFTH TECHNOLOGY TRANSFER INDUSTRIAL SEMINAR HELD IN KANSAS CITY, MISSOURI FOR MEAT PACKING INDUSTRY

The fifth EPA Technology Transfer Industrial Seminar for FY 1973, "Upgrading Meat Packing Facilities to Reduce Pollution" was given to 160 engineers and managers from the Meat Packing Industry in Kansas City, Missouri on March 7, 8, 1973.

EPA Regional Director Jerome Svore and John Dunning of the National Independent Meat Packers welcomed the attendees. Pretreatment requirements and surcharges were discussed by Richard Frank and Permit requirements were discussed by Garry Stigall both of Region VII.

Two technology sessions were presented. The first session on "In-Plant Modifications and Pretreatment" was by A. J. Steffen of Purdue University. The second session on Waste Treatment Systems was given by Jim and Paula Wells of Bell, Galyardt & Wells.

A special evening panel session was held on Odor Control. Donald Dencker of Oscar Mayer and Kenneth Ries of Armour joined Al Steffen and Jim Wells to form the panel.

The final general session included a presentation on "Optimum Strategies for Financing Pollution Control Investments" by Charles Marshall of J. A. Commins and Associates, and a talk on Effective Government-Industry relationships by Donald Mackenzie of the American Meat Institute.

EPA Technology Transfer Chairman for Region VII is Lewis Young.

METAL FINISHING SEMINAR

The third in the series of industrial seminars on "Upgrading Metal Finishing Facilities to Reduce Pollution" was held in Portland, Oregon on May 16-17. Approximately 140 metal finishers and government officials attended the seminar. The technical sessions included a presentation on In-Process Pollution Abatement by Alan Olsen of Oxy-Metal Finishing and Edward Hanf of Ceilcote, Inc. and a presentation on Metal Finishing Waste Treatment by Dr. Leslie Lancy and Robert Rice of Lancy Laboratories. In the general sessions Dr. William Brungs of the EPA National Water Quality Laboratory, Duluth, Minnesota, gave a stimulating talk on the Effect of Heavy Metal Discharges on the Aquatic Environment and James Commins of J. A. Commins and Associates gave a presentation on Choosing the Optimum Financial Strategy. A status report on the EPA demonstration grants involving metal

finishing plants was given by Dr. Herbert Shovronak of EPA's Edison Laboratory.

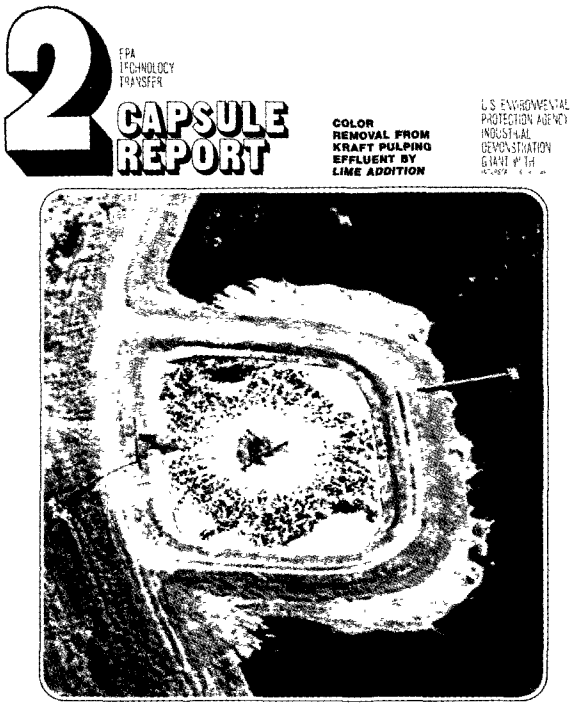
EPA TECHNOLOGY TRANSFER CAPSULE REPORT #2 AVAILABLE

EPA Technology Transfer Capsule Report Number 2 "Color Removal from Kraft Pulping Effluent by Lime Addition" is now being distributed. This capsule report describes an EPA Industrial Demonstration Grant with the Interstate Paper Corporation at Riceboro, Georgia.

Lime treatment, clarification, holding in a quiescent biological pond, and final aeration were used to reduce color from the Interstate unbleached kraft mill from 1200 APHA units to 125. BOD was reduced from 41 lbs/ton pulp (330 ppm) to 0.6 lb/ton pulp (5 ppm). Calcium was removed in the final effluent by natural recarbonation in the quiescent lagoon.

The capsule report lists the performance and economics of the system.

For your copy of this Capsule Report use the order blank at the back of this newsletter.



EPA TECHNOLOGY TRANSFER CAPSULE REPORT #3 AVAILABLE

EPA Technology Transfer Capsule Report Number 3 "Pollution Abatement in a Copper Wire Mill" is now available for distribution. The capsule report describes the EPA Industrial Demonstration Grant with the Volco Brass and Copper Company at Kenilworth, New Jersey.

The new system demonstrated that water consumption could be reduced by 90% (from 200,000 gallons per day to 20,000 gallons per day) by employing integrated chemical rinsing and water reuse. The sulfuric acid pickle was regenerated and high purity metallic copper recovered by continuous electrolysis, eliminating the dumping of spent pickle liquor. Hydrogen peroxide was proven to be an improved secondary pickle and the chromates and fluorides previously used were eliminated.

The system has resulted in a $14,000 annual savings in the manufacturing operation as well as striking reductions in waste discharges. Details of the system performance and economics are highlighted in the capsule report.

For your copy of this Capsule Report use the order blank at the back of this newsletter.

EPA/AIChE WATER REUSE CONFERENCE HELD IN WASHINGTON APRIL 24-27

475 Engineers, Scientists and Environmentalists attended a four day national conference on complete reuse of industry water, jointly sponsored by EPA Technology Transfer and the American Institute of Chemical Engineers.

Water reuse in industry was examined from the point of view of technology, economics, administration, and legal procedures. Environmentalists and lawyers as well as engineers and scientists participated in the program.

The keynote address by Michele Metrinko, special assistant to the EPA Administrator, stressed the point that the time for detailed solutions to pollution problems has arrived. Ms. Metrinko stressed the necessity of joint efforts between industry, environmentalists and regulatory agencies to arrive at optimum pollution control requirements which will protect the environment but not cause economic and environmental disasters by forcing unworkable technology into application.

Technical sessions covered topics related to water reuse for a range of industries, including chemicals, power, petroleum refining, pulp and paper and metals production. A special session was held on the new water pollution control law which featured a discussion by J. R. Quarles Jr., EPA Assistant Administrator for Enforcement. The economics session discussed impacts on exports, economic benefits to citizens, the cost to industry, and the philosophy of treating water as a borrowed commodity.

Proceedings from this conference will be available from the American Institute of Chemical Engineers, 345 East 47 Street, New York, New York 10017.

Michele B. Metrinko shown here with AIChE's Executive Secretary, F. J. Van Antwerpen, gave the keynote address at the EPA/AIChE Conference.

EPA RESEARCH HIGHLIGHT

Air-Polluted Water

EPA's Western Fish Toxicology Station, located in Corvallis, Oregon, a field station of the National Water Quality Laboratory in Duluth, Minnesota, devotes a majority of its research effort to a water pollution problem called "air supersaturation".

Why are water pollution scientists so concerned about air pollution? Simple. The unwanted air, no matter how pure or how dirty, is dissolved in otherwise habitable water and can do great harm to aquatic life, especially fish. Thus, it is not an air pollutant in the most strict sense of the word, but rather a water pollutant.

Dr. Gerald Bouck, Chief of WFTS, states, "Water can be supersaturated to some minute degree by even a small amount of turbulence, however, such as huge volumes of water plunging over large waterfalls or over the spillways of giant dams, or thermal pollution, that causes lethal levels of supersaturation."

It is appropriate that WFTS is located in Oregon, for the Northwest's mighty Columbia River just 80 miles to the north is highly supersaturated during the late spring and early summer, primarily as the result of nine major flood-control and hydroelectric dams.

As water plunges into basins below the dams, increased pressure forces gases from the air into solution in the water. As fish and other aquatic animals take in this unnaturally-high amount of gas pressure through normal respiratory processes, small bubbles are formed in the bloodstream, under the skin, and in the fins. External bubbles are easily seen with the naked eye.

The affliction is called "gas bubble disease."

Because the Columbia is a major migration route for the hundreds of thousands of Pacific salmon moving each year to and from spawning grounds in countless smaller tributaries, several species of this commercially-important fish are the main subjects of air supersaturation and gas bubble disease research at WFTS.

The Columbia River supplies about 65 percent of the commercial and sport-caught salmon landed off the coast of Oregon and Washington, which in turn generates tourist traffic twice that of Yellowstone National Park. The combined economic impact of salmon in the Northwest is estimated to be approximately $130 million annually. The loss of salmon means damage both to the environment and to the region's economy.

Air supersaturation, through gas bubble disease, causes the premature death of significant numbers of salmon each year.

During the spring runoff period, the Columbia River is supersaturated from the Pacific Ocean upstream for hundreds of miles, but the concentration is greatest in pools immediately below the spillways of dams. Most species of the adult salmon remain in these pools for many hours, or even days, before finding the fish ladders that will enable them to migrate upstream. Thus, any delay in their migration may cause great damage via gas bubble disease.

Since some of the migrating salmon must pass all nine dams to return to their spawning ground, those that go the farthest are likely to suffer heaviest casualties from gas bubble disease.

Gas bubble disease is similar to "the bends" or decompression sickness, suffered by skin divers. Small bubbles of gas form in the circulatory

system of the fish, blocking the flow of blood and causing weakness and a variety of other physical ailments.

The tiny bubbles can cause severe eye damage by clogging blood vessels, which may then lead to protruding eyeballs and blindness. The vision impairment prevents natural reproduction via behavioral problems and infectious disease.

Typically, death is caused by massive blockage of blood vessels. In advanced stages, the heart chambers of the fish become "air locked" by frothy bubbles.

Currently, research related to this problem is being conducted at WFTS using 2,000-gallon tanks and water supersaturated up to 130 percent with different species of fish and under varying environmental conditions. The results and future plans of this research can be obtained by contacting Dr. Bouck at the Western Fish Toxicology Station, 200 S. W. 35th Street, Corvallis, Oregon 97330.

WFTS conducts research with all life stages of fish. The adult salmon, some of them up to four feet long and weighing more than 35 pounds, are trapped by WFTS staff members on fish ladders at dams along the Columbia River.

The laboratory obtains most of its juvenile salmon through artificial spawning. Roe are collected from the adult females, fertilized, and hatched in incubators.

As research progresses, WFTS hopes to reach the point of being able to release experimentally-stressed salmon into the nearby Willamette River, so that the overall adequacy of water pollution restrictions can be tested more naturally and adequately.

Roe from a "ripe" female Chinook salmon will provide a new generation of test animals for WFTS research.

The field station also conducts research on the effects of heavy metals and other pollutants on salmon and trout.

While much of the air supersaturation in the Northwest is caused by the spillage of flood water, dams in other parts of the country cause supersaturation by deliberately injecting air into the turbines for re-aeration or for reducing mechanical problems. Thermal pollution is still another manmade cause of supersaturation.

According to Dr. Bouck, the cost of correcting supersaturation on the Columbia River alone could be quite high. The total cost could run between 50 million and a billion dollars, depending on the standards adopted, and on the supersaturation standard.

NEW AUDIO/VISUAL MATERIAL UNDER PRODUCTION

Technology Transfer has recently contracted for the production of two 28-minute 16mm documentary-type motion pictures depicting the successful application and implementation of new technology.

The first of these films will present the developopment and current implementation of the water quality management plan for the Alameda Creek Watershed in suburban San Francisco. This particular plan involves: a) upgrading two wastewater treatment facilities to "advanced waste treatment", including nutrient removal, producing an effluent suitable for reuse; b) conveyance of the reclaimed wastewater to a reservoir to be constructed; c) development of associated recreational facilities at the reservoir; and d) potential recycling of reclaimed wastewater. The cooperative efforts of the Alameda County Flood Control and Water Conservation District, the City of Livermore, the City of Pleasanton, and the Valley Community Services District played a major role in development of the plan.

The second film will document the successes of the Municipality of Metropolitan Seattle (METRO) in the area of environmental protection and enhancement. New wastewater treatment technology applied by Seattle METRO include the areas of sludge dewatering, phosphorus removal, and computerized treatment and disposal methods. METRO now serves 11 cities, 18 sewer districts, and one private agency—or a total of 900,000 people in a 300 square mile area. Again, this is an example of how new technology can be applied through inter-jurisdictional cooperation.

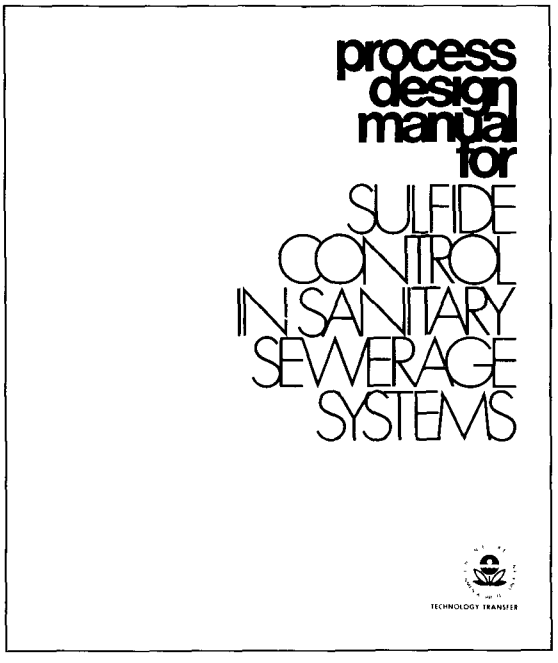
Each of these films is scheduled for completion by the end of calendar year 1973.

SULFIDE CONTROL MANUAL IN PRINT

The Technology Transfer Process Design Manual for Sulfide Control in Sanitary Sewerage Systems, prepared by Pomeroy, Johnston and Bailey of Pasadena, California, is currently being printed and will soon be available for distribution. This Manual includes information for all feasible alternative designs that can be used to control sulfides and minimize their effects in both new and existing sewerage systems.

Specific topics covered include: Characteristics and Properties of Hydrogen Sulfide; Occurrence and Effects of Sulfide in Sewers; Investigation in Existing Systems; Control of Sulfide in Existing Systems; and Design of Sewer Systems to Prevent Sulfide Problems. Case histories, examples, and cost estimates are presented to substantiate the "how-to" approach of this manual.

Individuals interested in obtaining, at no charge, a copy of the Sulfide Control Manual should fill out the appropriate form in the back of this publication and forward it to Technology Transfer, U. S. Environmental Protection Agency, Washington, D.C. 20460.



"HANDBOOK FOR MONITORING INDUSTRIAL WASTEWATER" TO BE AVAILABLE IN AUGUST

The first of the EPA Technology Transfer Industrial Manuals will be available in August of 1973. The "Handbook for Monitoring Industrial Wastewater" provides technical information for manufacturers establishing a wastewater monitoring program. As is the case with all Technology Transfer publications the Handbook is offered as helpful guidance only and is not regulatory.

Major chapters in the Handbook are:

- Program Planning
- Parameters to be Measured
- Analytical Considerations
- Sampling
- Flow Measurement
- Data Analysis
- Automatic Monitoring
- The Continuing Program
- Special Considerations for Municipal Systems
- Training of Technicians
- Safety

The manual is written with basic information for managers in the beginning of each chapter with the more detailed technical information in the latter sections. Special emphasis is placed on minimizing the costs of monitoring and avoiding common pitfalls.

For your copy of this handbook mail the form on the last page of this newsletter to Technology Transfer.

NOTICE: The new Technology Transfer telephone number is (703) 557-7700.

U. S. GOVERNMENT PRINTING OFFICE 1973--546-312/149

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 your EPA Regional Technology Transfer Committee Chairman from the list below:

REGION	CHAIRMAN	ADDRESS
I	Lester Sutton	Environmental Protection Agency John F. Kennedy Federal Building Room 2304 Boston, Massachusetts 02203 617 223-7210 (Maine, N.H., Vt., Mass., R.I., Conn.)
II	Rocco Ricci	Environmental Protection Agency 26 Federal Plaza New York, New York 10017 212 264-8958 (N.Y., N.J., P.R., V.I.)
III	Kenneth Suter	Environmental Protection Agency 6th & Walnut Streets Philadelphia, Pennsylvania 19106 215 597-9875 (Pa., W.Va., Md., Del., D.C., Va.)
IV	Asa B. Foster, Jr.	Environmental Protection Agency Suite 300 1421 Peachtree Street, N.E. Atlanta, Georgia 30309 404 526-3454 (N.C., S.C., Ky., Tenn., Ga., Ala., Miss., Fla.)
V	Clifford Risley	Environmental Protection Agency 1 N. Wacker Drive Chicago, Illinois 60606 312 353-5756 (Mich., Wis., Minn., Ill., Ind., Ohio)
VI	Richard Hill	Environmental Protection Agency 1600 Patterson Street, Suite 1100 Dallas, Texas 75201 214 749-1461 (Texas, Okla., Ark., La., N. Mex.)
VII	Lewis Young	Environmental Protection Agency 1735 Baltimore Avenue Kansas City, Missouri 64108 816 374-2725 (Kansas, Nebr., Iowa, Mo.)
VIII	Russell Fitch	Environmental Protection Agency 1860 Lincoln Street Denver, Colorado 80203 303 837-3849 (Colo., Mont., Wyo., Utah, N.D., S.D.)
IX	Frank Covington	Environmental Protection Agency 100 California Street San Francisco, Calif. 94111 415 556-0218 (Calif., Ariz., Nev., Hawaii)
X	John Osborn	Environmental Protection Agency 1200 6th Avenue Seattle, Washington 98101 206 442-1296 (Wash., Ore., Idaho, Alaska)

REQUESTS FOR TECHNOLOGY TRANSFER MATERIAL

Please send me the following publications at no charge. (Check appropriate boxes)

PROCESS DESIGN MANUALS

- ☐ Phosphorus Removal
- ☐ Carbon Adsorption
- ☐ Suspended Solids Removal
- ☐ Upgrading Existing Wastewater Treatment Plants
- ☐ Sulfide Control in Sanitary Sewerage Systems

TECHNICAL CAPSULE REPORTS

- ☐ Recycling Zinc in Viscose Rayon Plants
- ☐ Color Removal from Kraft Pulping Effluent by Lime Addition
- ☐ Pollution Abatement in a Copper Wire Mill

INDUSTRIAL SEMINAR PUBLICATIONS

- ☐ Upgrading Poultry Processing Facilities to Reduce Pollution
- ☐ Upgrading Metal Finishing Facilities to Reduce Pollution

BROCHURES

- ☐ Physical-Chemical Treatment
- ☐ Phosphorus Removal
- ☐ Upgrading Existing Wastewater Treatment Plants
- ☐ Carbon Adsorption
- ☐ Oxygen Aeration
- ☐ Nitrogen Control
- ☐ Seattle, Washington METRO
- ☐ Wastewater Purification at Lake Tahoe
- ☐ Indian Creek Reservoir
- ☐ Richardson, Texas

HANDBOOKS

- ☐ Analytical Quality Control in Water and Wastewater Laboratories
- ☐ Monitoring Industrial Wastewater

Please contact me regarding the loan of the following audio/visual material. (Check appropriate boxes)

MOTION PICTURES (16mm sound)

- ☐ Richardson, Texas, Project—Title "Somebody around here must be doing something good." (15 min.)
- ☐ Phosphorus Removal (5 min.)

VIDEOTAPES

- ☐ Carbon Adsorption (40 min.)
- ☐ Upgrading Activated Sludge Treatment Plants (40 min.)

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TECHNOLOGY TRANSFER

The Bridge Between Research and Use

U.S. ENVIRONMENTAL PROTECTION AGENCY

The Impact of Research, Development and Demonstration

The feature article of this issue deals with the use of new technology in municipal wastewater treatment. The article indicates a dramatic increase in the use of new technology within the past two years. A great deal of the increase is due directly or indirectly to the EPA Technology Transfer effort. Most of the technology involved in the Technology Transfer Program has evolved from the research, development and demonstration programs of the EPA Office of Research and Monitoring headed by Dr. Stanley M. Greenfield. The support and direction by Dr. Greenfield have been the key factors in the success of the Technology Transfer effort and have insured that the end products of the EPA research and demonstration programs are transmitted to potential users in a timely and effective manner.

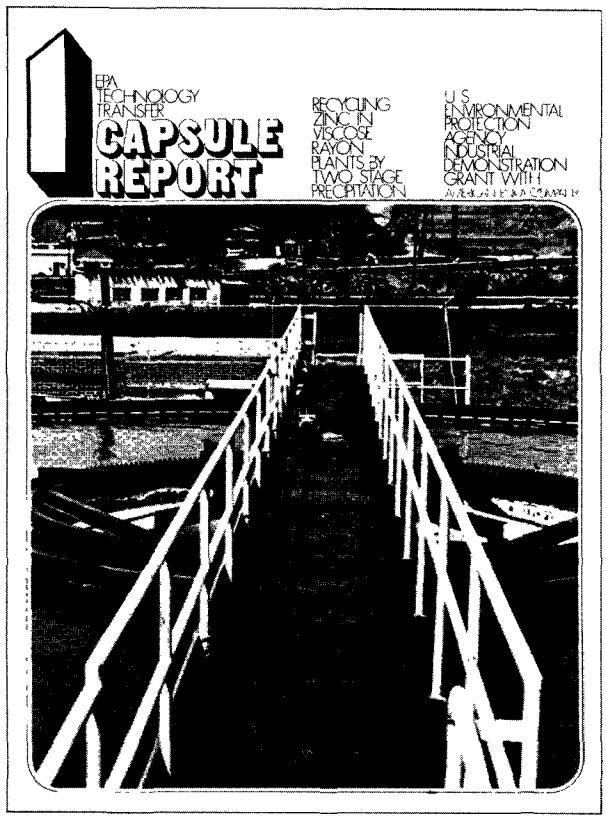
Several months ago the Technology Transfer Program was redirected by Dr. Greenfield, from a municipal wastewater treatment orientation to a more comprehensive approach to environmental pollution control including air, water, and solid wastes. The results of this re-orientation are now starting to become apparent, particularly in the industrial activities such as the recent seminars.

First Technical Capsule Report Published

The first in a continuing series of Technical Capsule Reports has been completed and is now available. Purpose of these documents is to provide the technical manager of a manufacturing plant with the essential information resulting from EPA Industrial Demonstration Projects. The Capsule Reports are so structured that the key technical and economic information is briefly, yet accurately, presented and can be readily understood in one reading.

"Recycling Zinc in Viscose Rayon Plants by Two-State Precipitation" is the title of the first Technical Capsule Report. Results of an EPA Demonstration Grant with the American Enka Company are presented and discussed. In this grant, a process for precipitating a dense sludge of high zinc assay was proven. The zinc in the sludge was recovered and recycled to the rayon manufacturing plant with no ill effects on the rayon

Dr. Stanley M. Greenfield, Assistant Administrator for Research and Monitoring, speaking at a Technology Transfer Design Seminar.



yarn. Not only can this process have immediate application in other viscose rayon manufacturing plants, but it could be applied to any waste stream containing soluble zinc in a form which can be precipitated by lime or caustic addition.

A copy of this *Technical Capsule Report* can be obtained by filling out the form in the back of this publication and forwarding it to your local Technology Transfer Committee Chairman.

Municipal Design Seminars

The Technology Transfer design seminar program sponsored four seminars since October 1972, bringing the total number of municipal design seminars conducted since the program was initiated to 19. The most recent seminars presented were in Denver, Colorado, October 31, November 1-2; Anaheim, California, November 13-14; Chicago, Illinois, November 28-30; and Boston, Mass., December 5-6.

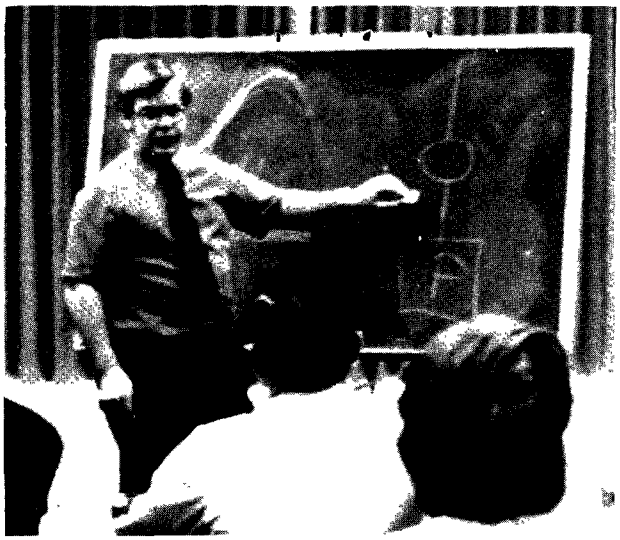
The Denver Seminar included sessions on physical-chemical treatment, upgrading existing wastewater treatment facilities, and phosphorus removal. Mr. John A. Green, Regional Administrator, Region VIII, gave the opening welcome to the consulting engineers and regulatory personnel in attendance.

The Anaheim Seminar covered the technical considerations for sludge handling and disposal. This was the initial Technology Transfer seminar in this area and was well-received. A highlight of the seminar was the presentations on the Sludge Handling and Disposal research program of the Los Angeles County Sanitation Districts by Mr. Walter E. Garrison, Assistant Chief Engineer and Assistant General Manager, and Dr. Raymond F. Rodgrique, Project Engineer.

John A. Green, Regional Administrator, Region VIII, addressing the general session at Denver municipal design seminar.

John R. Harrison of Black, Crow & Eidsness, Inc. presenting a portion of the technical session in Anaheim.

Francis T. Mayo, Regional Administrator, Region V, at Chicago design seminar.



John M. Smith during Upgrading session in Chicago seminar.

Technical sessions on upgrading existing wastewater treatment facilities, nitrogen control, and phosphorus removal were included in the Chicago Seminar. The general session covered aspects of the Federal Water Pollution Control Act Amendments of 1972. Mr. Albert C. Printz, Director, Office of Permit Programs, EPA, Washington, D.C., made this presentation to the 120-plus consulting engineers and regulatory personnel in attendance from the Great Lakes area. Mr. Charles Swanson, Office of Air and Water Programs, EPA, Washington, D.C., discussed Technical Bulletins and Design Guidelines in light of the new legislation. Francis T. Mayo, Regional Administrator, Region V, spoke on "New Thrusts in Great Lakes Water Pollution Control."

The Boston Seminar also covered sludge handling and disposal. Dr. Clifford V. Smith, Deputy Regional Administrator, Region I, welcomed the attendees to the seminar.

Feature presentations at the above design seminars were given by Brown and Caldwell Consulting Engineers, San Francisco, Calif.; Black, Crow & Eidsness, Inc., Wilmington, Del., Hazen and Sawyer Engineers, New York, N.Y.; Metcalf & Eddy, Inc., Boston, Mass.; CH_2M/Hill, Reston, Va.; and Shimek, Roming, Jacobs & Finklea, Dallas, Texas. Assistance from the EPA National Environmental Research Center in Cincinnati, Ohio was provided by Jesse Cohen, Ed Barth, Joseph Farrell, John Smith, James Smith, and Irwin Kugelman.

WWEMA Conference and Exposition

Technology Transfer has been invited to participate on the program and provide an exhibit for the Water and Wastewater Equipment Manufacturers Association (WWEMA) "Conference and Exposition on Industrial Water and Pollution" to be held in Chicago, Illinois, March 14-16, 1973. Both the presentation and exhibit will highlight the status and future activities of Technology Transfer's industrial program. The exhibit will also be the focal point for the distribution of Technical Capsule Reports and technical handouts from the industrial seminar series.

The WWEMA Conference is entirely industrially oriented and will feature an extensive technical program which includes case histories, roundtable discussions, and presentations on new treatment equipment as well as the equipment exposition. For additional information, contact Robert C. Hughes, WWEMA, 744 Broad Street, Newark, N.J. 07102.

Southern Textile Exposition

The 27th Southern Textile Exposition (held in Greenville, S.C., October 16-20, 1972) was attended by 30,000 executives, engineers, scientists, and buyers connected with the textile industry throughout the

Asa B. Foster, Jr., EPA Region IV.

world. EPA participation in this exposition—the largest in the textile industry—included the Technology Transfer exhibit previously used at the WPCF annual conference in Atlanta. Asa B. Foster, Jr., Categorical Programs Chief, Region IV, coordinated the entire EPA effort at the Southern Textile Exposition.

Infiltration-Inflow Seminars

Technology Transfer is in the final planning stages of developing a seminar series covering the subject of excessive infiltration/inflow in sewer systems. The seminar series is in answer to a direct request from the Office of Water Programs to impact the Federal Water Pollution Control Act Amendments of 1972. The Act states that the Administrator shall not approve any grants after July 1, 1973, for treatment works unless the applicant shows to the satisfaction of the Administrator that each sewer system discharging into such treatment works is not subject to excessive infiltration/inflow. Seminars will be held in each region and will clarify the regulations and guidelines as related to excessive infiltration/inflow and go into survey and analysis procedures and infiltration control techniques.

Use of New Technology in Municipal Wastewater Treatment

Until recently, the accepted methods of municipal wastewater treatment were primary or secondary treatment basically consisting of sedimentation and/or biological treatment. Biological processes usually consisted of trickling filtration and activated sludge or the various modifications of the activated sludge process, such as contact stabilization, extended aeration, and step aeration. Oxidation ponds or lagoons also were and are widely used, particularly in the midwestern areas of the United States. A summary of municipal wastewater treatment facilities in the United States in 1968, taken from the Federal Water Quality Administration's Municipal Inventory, is shown in the accompanying table. It should be noted that only ten "tertiary" or advanced wastewater treatment facilities were included in the inventory just four years ago.

During the past two years, however, the adoption of new or advanced municipal wastewater treatment technology has accelerated at a dramatic rate. It is difficult to precisely determine the causes for the rapidly spreading acceptance of new technology. While a major amount of new treatment designs may be attributed directly or indirectly to the efforts of the Technology Transfer Program, it is undoubtedly true that other factors have also played a role. These include more stringent water quality standards and requirements, increased social awareness of environmental problems, institutional changes in State and municipal regulatory agencies and the efforts of professional engineering organizations. Some of the major advanced wastewater treatment processes and techniques now rapidly finding their way into municipal treatment plant designs are presented and briefly discussed below.

Municipal Wastewater Treatment Systems

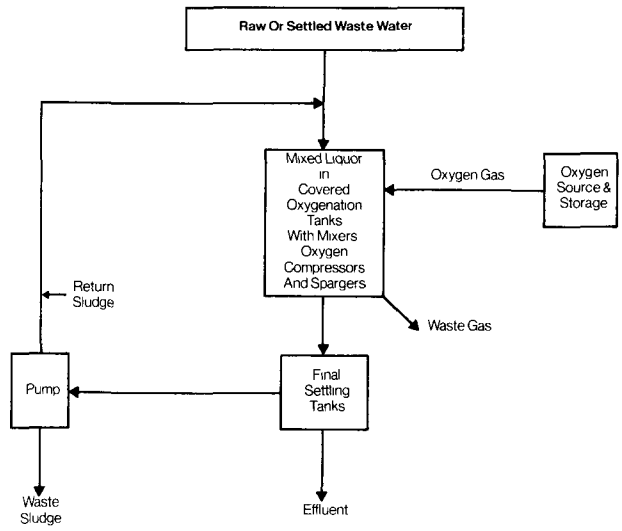
Treatment System	1968		November 1972	
	Number of Plants	Estimated Population Served	Number of Plants	Estimated Population Served
Primary Treatment	2,384	36,947,000	2,725	46,972,000
Intermediate Treatment	75	5,858,000	64	5,864,000
Secondary Treatment				
Trickling Filters	3,786	28,419,000	3,471	28,512,000
Activated Sludge	2,110	41,264,000	2,991	47,100,000
Oxidation Ponds	3,457	6,123,000	4,488	7,334,000
Tertiary Treatment	10	325,000	445	2,800,000
Total	11,822	118,936,000	14,184	138,582,000

Pure Oxygen Activated Sludge

Historically, the oxygen required in the activated sludge treatment process has been provided by the introduction of atmospheric air into the treatment system. Oxygen gas, however, possesses certain characteristics which can make its use, in lieu of atmospheric air, advantageous. One of these is the high partial pressure of pure oxygen—approximately 4.7 times that of oxygen in air. This allows for the maintenance of a greater reservoir of dissolved oxygen in that portion of the treatment system needing it.

The basic concept of using pure oxygen rather than air in the activated sludge process originated more than twenty years ago. It has been just recently, however, that oxygen aeration has become economically feasible due to technological advances in oxygen production and gas contacting equipment. In 1968, an EPA funded research project at Batavia, New York, conducted by the Linde Division of Union Carbide Corporation, successfully demonstrated the use of pure oxygen in a full-scale application. Since that time additional research pilot and full-scale operation have confirmed that the successful use of pure oxygen represents a major advance in wastewater treatment technology. A summary of some

Oxygen Process Flow Sheet



of the advantages of high purity oxygen treatment systems includes:

1. Highly mixed liquor suspended solids (MLSS) concentrations
2. Low detention periods
3. Low quantities of excess biological sludge

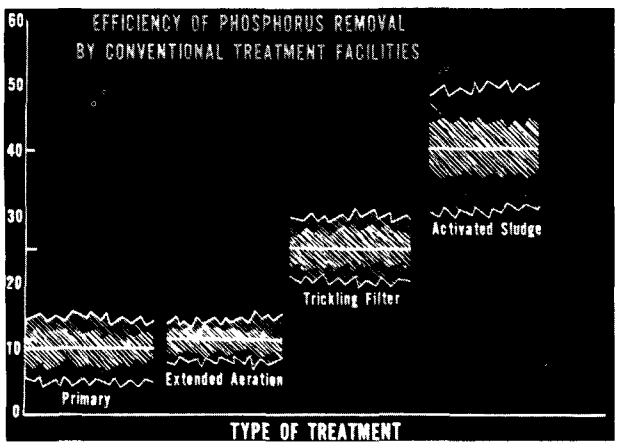
4. Improved sludge settling characteristics
5. Reduced power requirements
6. High dissolved oxygen levels in all stages
7. Low waste gas volume

Oxygen aeration is equally applicable to the upgrading of existing overloaded secondary treatment facilities as it is to new plant design and construction. Several applications include:

1. Upgrading of existing overloaded activated sludge plants by conversion from air aeration to oxygen aeration.
2. Upgrading of existing trickling filter plants by adding oxygen aeration as a second stage biological step in the treatment system.
3. New plant construction, both with and without primary sedimentation.

The use of high purity oxygen has spread, and continues to spread, very rapidly throughout the country. Additional companies are entering the field with proprietary equipment and variations of the basic oxygen process. Currently, there are approximately 40 treatment plants with a total design capacity of approximately 1,500 mgd under design, construction or operation. A partial listing of wastewater treatment facilities that are now under design, construction, or operation utilizing oxygen aeration follows:

Location	Design Flow (MGD)
Detroit, Michigan	300
Middlesex County, N. J.	120
East Bay MUD, Calif.	120
Louisville, Ky.	105
Miami, Fla.	55
Hollywood, Fla.	36
Danville, Va.	24
Euclid, Ohio	22
Newtown Creek, N.Y.C.	20
Decatur, Ill.	18
Fayetteville, N. C.	16
Salem, Oregon	16
New Rochelle, N. Y.	14
Fairfax County, Va.	12
Jacksonville, Fla.	10
Speedway, Ind.	10
Morganton, N. C.	8
Deer Park, Texas	6
Baltimore, Md.	5



Phosphorus Removal

The technology for phosphorus removal from wastewater is now well established and spreading rapidly in those areas of the country faced with eutrophication problems. The number of municipalities that are either currently removing phosphorus, or planning removal in the near future, is now so lengthy and growing so rapidly that it is impractical to attempt to list them. There are, however, approximately 150 treatment facilities that are in these categories at the present time with the vast majority located in the Great Lakes area.

Chemicals For Phosphorus Removal

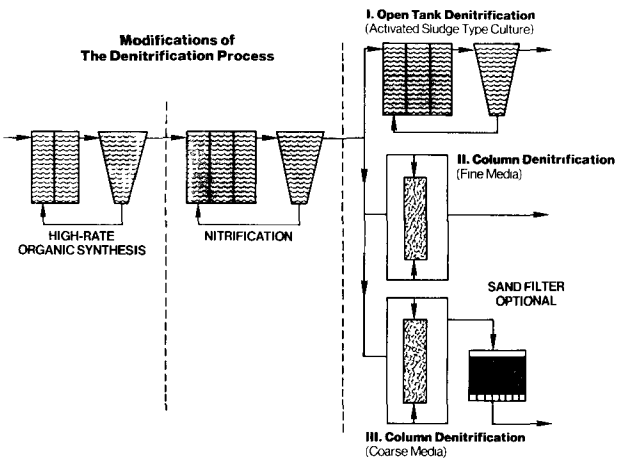
Ferric Chloride	$FeCl_3$
Ferric Sulfate	$Fe_2(SO_4)_3$
Ferrous Chloride	$FeCl_2$
Ferrous Sulfate	$FeSO_4$
Alum	$Al_2(SO_4)_3$
Sodium Aluminate	$NaAlO_2$
Steel Mill Pickling Liquor	$FeCl_2 + FeSO_4$
Lime	$Ca(OH)_2$

Effective phosphorus removal is accomplished primarily by chemical precipitation. Phosphorus forms insoluble precipitates with a number of chemicals; however lime, salts of iron and salts of aluminum are the chemicals that are currently economically feasible for use. The precipitation of phosphorus must be followed by liquid solids separation. Fortunately, this can be accomplished relatively simply and economically in existing conventional biological treatment plants. A major side benefit to chemical precipitation and removal of phosphorus is the coagulation and removal of additional organic solids with a resultant increase in the BOD and suspended solids removal efficiency of the treatment plant. Total phosphorus in the effluent can now typically be reduced to 1 mg/1 or less. One of the prime factors in the rapid acceptance of phosphorus removal by chemical precipitation is the relatively low initial capital cost and the ease of equipment installation. Basic equipment required consists primarily of chemical storage tanks, polymer storage tanks (where needed) and chemical pump and feed lines. Chemical precipitation for phosphorus removal is now becoming so widely accepted and used that it will soon be considered as part of the "conventional" state-of-the-art and no longer considered as a type of advanced wastewater treatment.

Nitrogen Removal

Nitrogen is being identified as the controlling nutrient in eutrophication in some areas of the country. The removal of nitrogen is therefore becoming an increasingly important area of wastewater treatment technology. There are currently four principal methods of nitrogen removal:

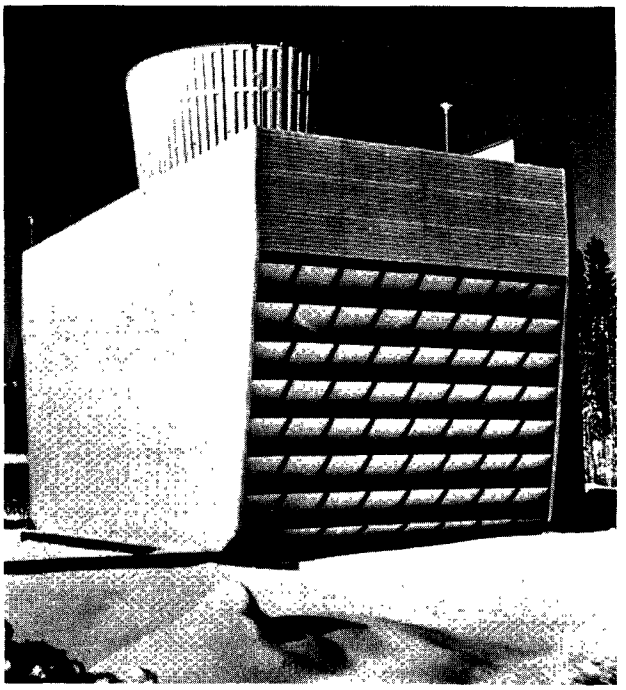
Biological Denitrification: A three-stage biological system has been developed under the EPA research program



to remove nitrogen. The first stage is a high rate, short aeration time (about 2 hours), biological reactor for organic carbon oxidation, and hydrolysis of organic nitrogen to ammonia. The second stage provides about 3 hours of detention and achieves essentially complete nitrification. The third stage is for denitrification of nitrate to nitrogen gas. An organic source must be added to the third stage to force the denitrification reaction to take place. Methanol has thus far been found to be the most effective source since it is relatively inexpensive, reacts rapidly, and provides only a minimum of energy for growth of new organisms. The theoretical requirement is 1.9 mg methanol per mg of nitrate-N. In practice, a dose of about 3 mg methanol to 1 mg nitrate-N is required to compensate for synthesis and the demand exerted by dissolved oxygen remaining in the wastewater after the nitrification stage. Biological nitrification/denitrification is now being designed for large capacity treatment plants at the Blue Plains treatment plant in Washington, D.C. (309 mgd) and the Salt Creek Treatment Plant in Chicago (30 mgd).

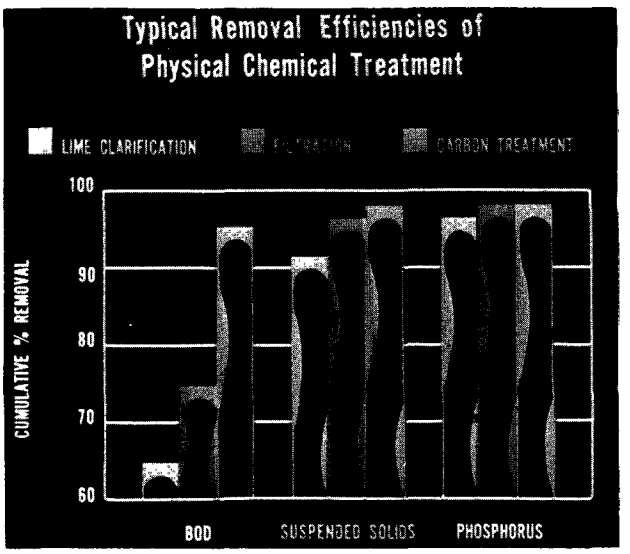
Breakpoint Chlorination: When chlorine is added to a wastewater containing ammonia nitrogen, the ammonia reacts with the hypochlorous acid formed to produce chloramines. The addition of chlorine, up to the breakpoint, results in conversion to and subsequent release of nitrogen gas. The chlorine breakpoint occurs as a ration of approximately eight to ten parts of chlorine to one part of ammonia-N. Data from EPA research projects indicates that ammonia-N concentration in the effluent can be reduced to 0.1 mg/1 if adequate mixing, dosing, and pH control is maintained. Two potential adverse effects of breakpoint chlorination are high chlorine residuals and mineralization in the form of chlorides. The high chlorine residuals may be overcome by installation of carbon contactors prior to discharge to the receiving waters. The receiving stream, however, must be capable of accepting the additional mineralization without adverse effects on proposed water usage.

Ammonia Stripping: Ammonia nitrogen may be removed from wastewater by raising the pH above 11, generally with lime used for phosphorus removal, and stripping out the ammonia with air. The classic application of ammonia stripping is the now well known experience at Lake Tahoe, California. The Tahoe stripping tower is 50 feet high, with forced ventilation, and packed with treated hemlock slats with 1-1/2 inch vertical and 2 inch horizontal spacing. Initial performance in the tower was good, removing about 90 percent of the ammonia in warm weather; however, long term operational problems have become evident. Freezing occurs during cold weather which reduces the utility of the process in those areas having prolonged periods of sub-freezing weather during the winter season. Calcium carbonate scaling has also proven to be a maintenance problem at the Tahoe plant.



Ammonia stripping tower at Lake Tahoe, California.

Selective Ion Exchange: The relatively recent discovery that a naturally occurring zeolite, clinoptilolite, had ion exchange properties favoring the exchange of ammonium over most other cations, makes ion exchange appear to have significant promise as being economically feasible for ammonium removal from wastewater. EPA research projects indicate that ion-exchange columns may be operated for approximately 24 to 30 hours before regeneration of the resin is required. Regeneration may be accomplished by a solution of lime and



sodium chloride. Current research also indicates that ammonia-N removal to levels of less than 0.5 mg/1 are technically feasible. Resin volume requirements are in the range of 0.1 to 1.0 lbs. of ammonia-N per cubic foot of resin. The Occoquan Sewage Authority treatment plant in Fairfax County, Virginia, with an initial plant design capacity of 22.5 mgd (with expansion to 45 mgd planned within the next decade) is currently being designed with the use of clinoptilolite for nitrogen removal.

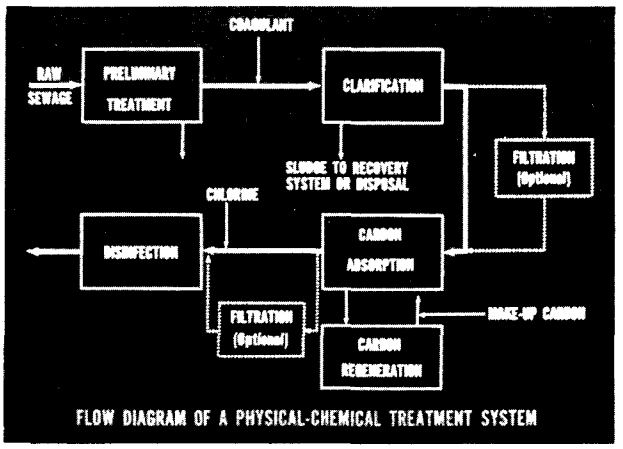
Physical-Chemical Treatment with Granular Activated Carbon

Physical-chemical treatment of wastewater has now become a major viable alternative to conventional biological treatment processes. There are presently more than 20 municipalities in the United States that are planning the use of physical-chemical treatment. A partial listing of some of these plants follows:

Location	Design Flow (MGD)
Niagara Falls, N. Y.	60
Cleveland, Ohio	50
Garland, Texas	30
Occoquan, Fairfax County, Va.	22.5
Alexandria, Va.	21
Upper Montgomery County, Md.	20
Fitchburg, Mass.	15
Orange County, Calif.	15
Rocky River, Ohio	10
Cortland, N. Y.	10
South Lake Tahoe, Calif.	7.5
Owosso, Mich.	6
Port Jefferson, N. Y.	5
Piscataway, Md.	5
Leetsdale, Penna.	5
Colorado Springs, Colo.	2.0
Leroy, N. Y.	1.5

There is some confusion as to what treatment processes the term physical-chemical (P-C) treatment includes. Physical-chemical treatment processes include chemical clarification, filtration, and activated carbon adsorption. P-C treatment may follow biological treatment processes, such as used at Lake Tahoe, or may be "independent" physical-chemical treatment which utilizes the P-C components only, without biological treatment. Chemical clarification of raw sewage will consistently provide 65 to 75 percent removal of organic material. Chemicals such as alum, lime or iron salts used for chemical clarification will also provide high degrees of phosphorus removal. Chemical clarification may be accomplished in a series of steps including mixing, flocculation and sedimentation. These steps may be combined in proprietary single units commonly designated as solids-contact clarifiers.

Carbon adsorption, which is the major new process involved in physical-chemical treatment of wastewater, provides removal of colloidal and dissolved organics



FLOW DIAGRAM OF A PHYSICAL-CHEMICAL TREATMENT SYSTEM

which cannot be removed by clarification or filtration. The adsorption process consists of passing the treated wastewater through carbon contactors, or beds of granular activated carbon. Carbon contactors may be of either the upflow or downflow types. Downflow columns provide a degree of filtration in addition to adsorption and have been operated at flow rates ranging from 2 to 8 gpm/ft^2. Periodic backwashing of downflow columns is required as the pressure loss increases due to suspended solids accumulating in the carbon bed. Carbon beds, or contactors, may be operated in the upflow mode as packed beds at low hydraulic loadings (less than 2 gpm/sq ft), as partially expanded beds at higher hydraulic loadings (4-7 gpm/sq ft), or packed against the top of the contactor at much higher hydraulic loading rates. Typical commercial granular carbon sizes used are 8 x 30 and 12 x 40 mesh.

As organics from the wastewater are adsorbed by the granular activated carbon, the carbon eventually requires regeneration in order to be reused. It is this regeneration and reuse of granular carbon that makes it economically feasible for wastewater treatment. Exhausted granular carbon is hydraulically transported in a water slurry, dewatered, and regenerated thermally by heating to 1500°F – 1700°F in a multiple-hearth furnace where the adsorbed impurities are volatilized and released in gaseous form. Carbon losses usually vary from 5 to 10 percent per regeneration cycle.

Filtration may be required prior to activated carbon adsorption in order to reduce the clogging rate of the carbon pores. The use of filtration, usually of the mixed-media type, also enables the use of packed upflow carbon beds as well as the packed downflow types, and will normally result in a more efficient removal of solids than carbon alone, with a resultant higher quality of effluent. When upflow expanded bed carbon contactors are used, filtration units may be used downstream of the carbon columns to remove the floc which is flushed from the carbon. Polymers may be fed to the filter influent to be used as coagulant aids.

Some of the advantages of physical-chemical treatment are:

1. Less area requirement. . . . . 1/2 to 1/4
2. Lower sensitivity to diurnal variation
3. Not affected by toxic substances
4. Potential for significant heavy metal removal
5. Superior removal of 'P' compounds
6. Greater flexibility in design and operation
7. Superior organic removal

Typical costs for a 10 mgd P-C treatment plant are shown in the following table:

Costs for Physical-Chemical Treatment (10 MGD)

Step	Total Cost (Cents per 1000 gals.)
Preliminary Treatment	0.8
Lime Coagulation & Recalcination	10.1
Filtration	3.6
Activated Carbon Adsorption	12.9
Disinfection	0.9
Total Plant Cost	28.3

Note: Total cost includes capital costs, operating and maintenance costs, & amortization.

Up to the present time, the use of physical-chemical treatment for municipalities has been considered economically feasible for plant sizes greater than 3-5 mgd due to the cost of carbon regenerating systems. However, a major commercial carbon supplier has recently introduced the concept of centralized regional regeneration plants which will eliminate a major capital cost for smaller facilities and could result in even more widespread use of physical-chemical treatment.

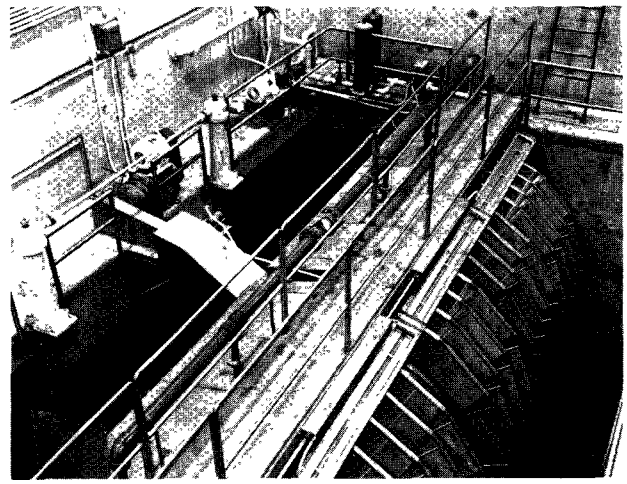
Suspended Solids Removal

New technology is also rapidly being adopted for upgrading the removal of suspended solids from conventional wastewater treatment systems. Gravity sedimentation is no longer providing adequate liquid-solids separation for many municipalities. Major advances in suspended solids removal include chemical clarification, deep-bed filtration, and microscreening.

Chemical Clarification. Chemical clarification for suspended solids removal has been discussed in some detail above, under the section on phosphorus removal. As noted previously, chemical clarification is now becoming standard practice in many parts of the country. Chemical clarification is the most feasible method for colloid removal. Chemical coagulation and clarification may be accomplished in either primary, secondary, or tertiary clarification units. The use of chemicals can often provide a municipality with the incremental BOD and suspended solids removal efficiency, necessary to meet water quality requirements, without major new additions to the treatment facility.

Deep-Bed Filtration. Filtration of secondary effluent provides a positive, reliable method of suspended solids removal. Deep-bed filters using two or more types of media provide a substantial increase in filter depth over single media type units. "Mixed" or tri-media filters, such as those used at Lake Tahoe, generally consist of layers of anthracite coal, sand, and garnet. The lower specific gravity (1.6) coal is on top and higher specific gravity (4) garnet is on the bottom to prevent excessive mixing of the media materials during backwashing. Filter depths are 24 to 30 inches with effective size gradations of about 1.0 mm at the top to about 0.15 mm at the bottom. Filters are operated at flow rates ranging from 5-10 gpm/sq ft. Mixed media deep-bed filters provide an excellent method of effluent quality assurance by removal of virtually all of the suspended solids and by high degrees of removal of turbidity and phosphorus.

Typical Performance of Chemical Clarification	
ORGANIC REMOVAL	60-80%
SUSPENDED SOLIDS REMOVAL	90-98%
PHOSPHORUS REMOVAL	80-95%



Microscreening installation in Chicago, Illinois.

Microscreening. Microscreens are surface filtration devices that are finding increasing use for polishing effluent from secondary biological treatment plants. The microscreen units consist of rotating drums with specially woven corrosion-resistant fabric mounted on the periphery. Influent enters the drum along the axis and flows radially outward through the fabric. The filtration or screening efficiency depends primarily on the fabric size and the character of the solids being removed. Microscreen units are available with variable drum speeds and backwash pressures to accommodate variations in flow and solids loading. Microscreens are washed continuously requiring approximately 5 percent of the filter throughput for this operation. Data from current installations indicate removal of 50 to 80 percent of the biological solids in secondary effluent using screen sizes from 23 to 35 microns.

The treatment processes and systems described above represent major advances in wastewater treatment technology and are, in most cases, being used, or ready for use in full-scale applications. Many other treatment processes are being developed under the EPA research and demonstration program including: the use of powdered carbon in physical-chemical treatment; the use of ozonation for oxidation of organics and disinfection; and the use of ion exchange and reverse osmosis for removal of dissolved inorganics. As the development of these and other new wastewater treatment processes progresses, we may expect to find the near-future inventory of municipal treatment processes expanding even more rapidly and more diversely than it has within the past three years.

Technology Transfer Co-Sponsors National Conference on Complete Water Reuse in Industry

Technology Transfer has joined with the American Institute of Chemical Engineers (AIChE) in sponsoring a National Conference on Complete Water Reuse in Industry, to be held in Washington, D.C., April 24-26, 1973. The conference will be organized into 21 sessions with approximately 70 papers to be presented covering most of the major industrial sources of pollution. Participation will be provided for industry, government and civic organizations, and environmentalists.

AIChE Annual Meeting

The 56th Annual Meeting of the American Institute of Chemical Engineers (AIChE), held in New York City, November 26-30, 1972, included participation by Technology Transfer. The Technology Transfer presentation centered on the then newly-initiated industrial program, which impacts air, water, and solid waste control and treatment technology.

Analytical Quality Control Handbook Receives Second Printing

A second printing of the Technology Transfer Handbook for Analytical Quality Control in Water and Wastewater Laboratories has recently been completed. The initial printing of 14,000 copies was exhausted in less than three months and an additional 10,000 copies was ordered in late October of last year. These additional copies are now available for distribution.

Pollution Control '73

Technology Transfer participated in the conference entitled "Pollution Control '73" sponsored by Chemical Engineering Magazine and held in New York City, December 12-14, 1972. The conference highlighted new legislative requirements, regulatory standards, technological alternatives available to control or treat effluents, and transfer of technology.

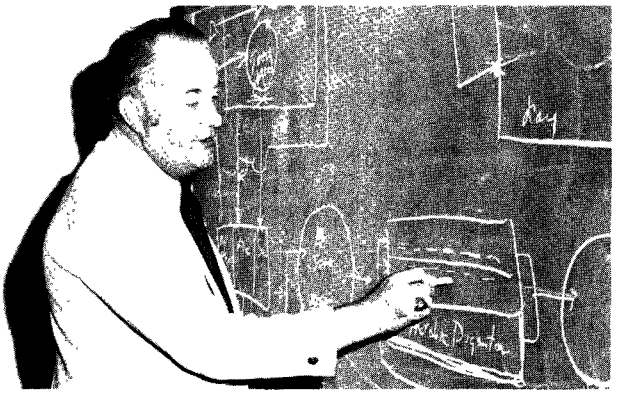
Technology Transfer to Participate in APWA Workshops

Members of the Technology Transfer staff will participate in the American Public Works Association (APWA) workshop series on sewerage and urban drainage systems. This series, aimed at Public Works Directors, starts in February and will be conducted in such cities as San Francisco, Oklahoma City, Cincinnati, Philadelphia, Chicago, New Orleans, and Los Angeles. The Technology Transfer staff members will serve as instructors for portions of these sessions and will also provide instructional materials. A key focus of the two-day sessions will be on upgrading existing wastewater treatment facilities.

These workshops are being conducted under the direction of Mr. Richard Sullivan of APWA. Additional information may be obtained from the APWA Education Foundation, 1313 East 60th Street, Chicago, Illinois 60637.

Industrial Waste Seminars

A major portion of Technology Transfer's industrial program is the industrial waste seminar series. These seminars are being used to disseminate technical information to specific industries concerning the control and treatment of air, water, and solid wastes. A typical seminar agenda includes such topics as legislative and regulatory requirements, effluent sampling techniques, in-plant modifications to reduce pollution, technology available for pretreatment prior to discharge of wastes to municipal systems, treatment and control technology for discharges to waterways, by-product recovery, air pollution control, and solid waste disposal.



Edward Willoughby, Giffels Associates, Inc., discussing treatment of poultry processing wastes at Atlanta seminar.

The seminars that have been held to date include "Upgrading Poultry Processing Facilities to Reduce Pollution" (Atlanta, Ga., September 1972), and "Upgrading Metal Finishing Facilities to Reduce Pollution" (New York, N.Y., December 1972). The favorable response to both seminars has resulted in the repeating of each; the former in Little Rock, Arkansas, January 16-18, and the latter in Philadelphia, Pa., January 30-31.

Two new seminars are now being presented. A seminar on "Upgrading Meat Packing Facilities to Reduce Pollution" will be held in Kansas City, Mo., in March and a seminar on "Upgrading Dairy Facilities to Reduce Pollution" will be held in EPA Region I the same month.

Design Manuals Receive Third Printing

Once again several Regional Offices have depleted their supply of the four Technology Transfer Process Design Manuals. As a result, a rush reprinting to satisfy the backlog of requests until the revised versions of the manuals become available later this year has just been completed. The number of copies of each manual in circulation after this printing now totals nearly 20,000.

Second Videotape Available

A videotape covering the topic of Upgrading Activated Sludge Treatment Plants is now available for loan from Technology Transfer on an availability basis. The tape is approximately 40 minutes in length and is composed of three segments: pre-plant considerations; in-plant process modifications; and effluent polishing. Requests for loan of this tape—the second produced by Technology

Transfer to date—may be made by completing the last page of this newsletter and forwarding it to your regional Technology Transfer committee chairman.

About This Publication

Recently there have been several inquiries as to whether this publication receives distribution monthly, quarterly, etc. Apparently some individuals feel they may have been inadvertently missed in a mailing. An attempt is made to publish this information document approximately once a quarter, but a rigid time frame is not established. We feel it is more important that the material presented be accurate, timely, and useful than it is to publish this document exactly every three months. This is why a period of more than three months may elapse between issues, and has several times in the past.

As a matter of further information, Technology Transfer has distributed more than 600,000 copies of its various publications in the last year and a half. Included in this total are over 400,000 copies of process and project brochures; approximately 100,000 copies of technical manuals and handbooks; and nearly 100,000 copies of this publication, which now has a mailing list of about 20,000.

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 your appropriate EPA Regional Technology Transfer Committee Chairman from the list below:

REGION	CHAIRMAN	ADDRESS
I	Lester Sutton	Environmental Protection Agency John F. Kennedy Federal Building, Rm. 2304 Boston, Massachusetts 02203 617-223-7210 (Maine, N.H., Vt., Mass., R.I., Conn.)
II	Rocco Ricci	Environmental Protection Agency 26 Federal Plaza New York, New York 10017 212-264-8958 (N.Y., N.J., P.R., V.I.)
III	Kenneth Suter	Environmental Protection Agency 6th & Walnut Philadelphia, Pa. 19106 215-597-9875 (Pa., W. Va., Md., Del., D.C., Va.)
IV	Asa B. Foster, Jr.	Environmental Protection Agency Suite 300 1421 Peachtree St., N.E. Atlanta, Georgia 30309 404-526-3454 (N.C., S.C., Ky., Tenn., Ga., Ala., Miss., Fla.)
V	Clifford Risley	Environmental Protection Agency 1 N. Wacker Drive Chicago, Illinois 60606 312-353-5756 (Mich., Wis., Minn., Ill., Ind., Ohio)
VI	Richard Hill	Environmental Protection Agency 1600 Patterson Street Suite 1100 Dallas, Texas 75201 214-749-1461 (Texas, Okla., Ark., La., N. Mex.)
VII	Lewis Young	Environmental Protection Agency 1735 Baltimore Avenue Kansas City, Missouri 64108 816-374-2725 (Kansas, Nebr., Iowa, Mo.)

REGION	CHAIRMAN	ADDRESS
VIII	Russell Fitch	Environmental Protection Agency 1860 Lincoln Street Denver, Colorado 80203 303-837-3849 (Colo., Mont., Wyo., Utah, N.D., S.D.)
IX	Frank Covington	Environmental Protection Agency 100 California Street San Francisco, Calif. 94111 415-556-0218 (Calif., Nev., Ariz., Hawaii)
X	John Osborn	Environmental Protection Agency 1200 6th Avenue Seattle, Washington 98101 206-442-1296 (Wash., Ore., Idaho, Alaska)

Request For Technology Transfer Material

Please send me the following publications at no charge. (Check appropriate boxes)

PROCESS DESIGN MANUALS

- ☐ Phosphorus Removal
- ☐ Carbon Adsorption
- ☐ Suspended Solids Removal
- ☐ Upgrading Existing Wastewater Treatment Plants

BROCHURES

- ☐ Physical-Chemical Treatment
- ☐ Phosphorus Removal
- ☐ Upgrading Existing Wastewater Treatment Plants
- ☐ Seattle, Washington METRO
- ☐ Wastewater Purification at Lake Tahoe
- ☐ Indian Creek Reservoir
- ☐ Carbon Adsorption

HANDBOOK

- ☐ Analytical Quality Control in Water and Wastewater Laboratories

TECHNICAL CAPSULE REPORT

- ☐ Recycling Zinc in Viscose Rayon Plants

Please contact me regarding the loan of the following audio/visual material. (Check appropriate boxes)

MOTION PICTURES (16mm sound)

- ☐ Richardson, Texas, Project—Title "Somebody around here must be doing something good." (15 min.)
- ☐ Phosphorus Removal (5 min.)

VIDEOTAPES

- ☐ Carbon Adsorption (40 min.)
- ☐ Upgrading Activated Sludge Treatment Plants (40 min.)

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ENVIRONMENTAL PROTECTION AGENCY

WPCF PRESIDENT PARTICIPATES IN NEW YORK DESIGN SEMINAR

Joseph F. Lagnese, President, Water Pollution Control Federation, participated in the Technology Transfer Design Seminar held in New York City February 29 and March 1-2, 1972.

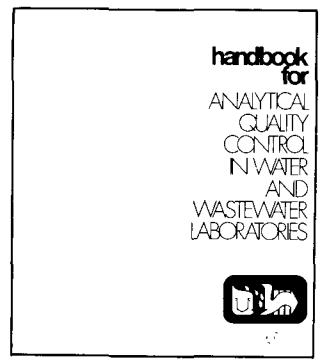
Mr. Lagnese opened the general discussion session on March 2 with a presentation on the cooperative efforts of the Federation and the Technology Transfer Program. He stated ". . . . there is no question that EPA Technology Transfer, by their special efforts, has achieved a position of respect and prestige with the Federation officially and I am sure with most of our members." Mr. Lagnese further stated: "Possibly even more significant and encouraging than the improved rapport between EPA and professional organizations is that the Federal program, by example of the Technology Transfer effort, demonstrates a more serious consideration to the essential role of engineering in the achievement of national water pollution control objectives."

Joseph F. Lagnese, President, Water Pollution Control Federation, addressing participants in New York Design Seminar.

One of the points discussed by Mr. Lagnese was that a conflict between the Technology Transfer Process Design Manuals and the WPCF Manuals of Practice does not exist as the respective areas of interest differ. He pointed out that: 1] whereas the MOP's are limited to well-established practices of rather long-term use, the Design Manuals on the other hand relate to process design in areas where research and demonstration has been more recent; and 2] the continued cooperation and coordination between WPCF and Technology Transfer would minimize the potential for overlap, redundancy, and conflict in the future.

The importance of this cooperation between the Federation and Technology Transfer was the main theme of Mr. Lagnese's presentation. ". . . . no other program in EPA or the water pollution control agencies preceding EPA, to my recollection, has had a better record in this regard" he concluded.

ANALYTICAL QUALITY CONTROL HANDBOOK



Initial distribution of the Handbook for Analytical Quality Control in Water and Wastewater Laboratories will take place at the 92nd annual meeting of the American Water Works Association to be held in Chicago, Illinois, June 4-9, 1972. The Handbook can be obtained at no cost at EPA's Technology Transfer exhibit; it will also be available free of

charge through the regional Technology Transfer committees listed in the back of this publication.

The quality control handbook was prepared for Technology Transfer by the EPA Analytical Quality Control Laboratory in Cincinnati, Ohio. Personnel from both programs will be available at the AWWA meeting to discuss the handbook in more detail, as well as the functions of the AQC Laboratory. Presented below is a summary of the responsibilities and mission of the AQC Laboratory.

The AQC Laboratory (Dwight G. Ballinger, Director) is part of the National Environmental Research Center in Cincinnati. Its Mission is the development of physical, biological, and microbiological methods for the field and laboratory analysis of water, wastewater, and sediment samples. Additional responsibilities include the evaluation of method reliability and the establishment of quality control techniques for EPA laboratories.

The Laboratory has a staff of 54 scientists and technicians and an in-house budget of more than $1 million annually. The Laboratory Staff monitors an additional one-half million dollars in contracts and grants related to methods development. Methods research involves improvements in automated colorimetric procedures, investigations of the usefulness of specific ion electrodes, improved methods for pesticides, and the development of techniques for GC-mass spectral identifications. Oil identification techniques based upon infrared and gas chromatography have also been developed by the Laboratory. Additional investigations include improved methods for heavy metals in water and wastes; the Laboratory has provided EPA methods for mercury in water, sediments, and fish, in response to the current crisis involving that element.

Biological field and laboratory methods are also being investigated with particular emphasis on the selection and evaluation of sampling devices, the preparation of detailed identification guides for micro- and macroorganisms collected in biological surveys, and procedures for the determination of biomass as a pollution indicator. The microbiological staff is engaged in studies of sample preservation, improved techniques for coliform, fecal coliform, and fecal strep organisms, and the development of methods for the identification and enumeration of enteric pathogens.

In support of the research, a special staff conducts evaluation of EPA methods to determine the applicability, precision, and accuracy, by means of interlaboratory studies. Studies have been completed or are being conducted for nutrient parameters, oxygen demand measurements, pesticides in water, heavy metals, and chlorophyll. Methods evaluation reports are prepared and distributed to EPA laboratories and other interested groups. The Laboratory also provides a unique service in the form of standard reference samples for water quality and waste analyses. These reference samples, based upon groupings of analytical parameters, are available from the Laboratory at no cost and may be used in the evaluation of individual laboratory techniques, analysts' performance, or in the investigation of new instrumental measurement systems.

The AQC Laboratory is responsible for the development of continuous monitoring instruments for use by EPA and other Government agencies. This development includes new sensor systems, computer interfacing with water quality monitoring instruments, improvement in intake design, and a recent development, the use of a satellite for data transmission.

Major accomplishments of the AQC Laboratory are measured in terms of publications. In 1971, the Laboratory distributed more than 10,000 copies of "Methods for Chemical Analysis of Water and Wastes." A recent publication of the laboratory is "Methods for Organic Pesticides in Water and Wastewater." In the summer of 1972, the Laboratory will publish "Methods for Collection and Analysis of Biological Field Samples," which is a cooperative effort among the principal biologists in EPA. In addition to publication of methods manuals, the Laboratory also publishes the quarterly AQC Newsletter, which goes out to many laboratories inside and outside the Government and offers a communication device relating to matters of quality control and methods development. The current mailing list for the newsletter numbers more than 5,000.

Among the more interesting challenges in methods development are methods for organophosphorus pesticides, the use of NMR for organic pollutant identifications, instrumentation for the continuous monitoring of industrial waste effluents, the development of biometric procedures, and improvements in the identification of oil slicks for enforcement purposes.

SECOND PRINTING OF DESIGN MANUALS COMPLETED

Technology Transfer has finally received the second printing of the Process Design Manuals initially released last October. Those individuals who have previously requested the manuals should be receiving them shortly; others interested in obtaining the manuals may do so by completing the last page of this fact sheet and forwarding it to the appropriate Regional Technology Transfer Committee Chairman. We express our regrets for the delay involved in distributing these manuals and our thanks to all those who have patiently awaited their receipt.

DESIGN SEMINARS

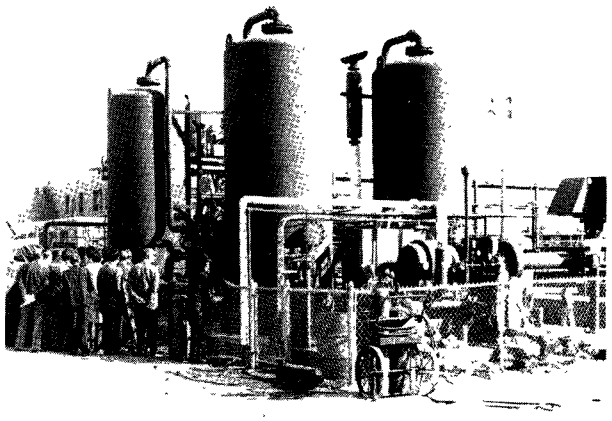
The Technology Transfer design seminar program sponsored three seminars since January, 1972, bringing the total number of seminars conducted since the program was initiated to twelve. The most recent seminars were presented in Anaheim, California, January 5 and 6; New York, New York, February 29, March 1, and 2; and Anchorage, Alaska, March 28 and 29, 1972.

The Anaheim Seminar included sessions on physical-chemical treatment, nitrogen control, and suspended solids removal. Mr. John D. Parkhurst, Vice-President, Water Pollution Control Federation, discussed the EPA Technology Transfer Program with regard to the Federation as part of the opening half-day session.

John D. Parkhurst, Vice President, Water Pollution Control Federation, discussing the Technology Transfer Program in Anaheim.

A Seminar was held in New York City during February 29, March 1 and 2, 1972. The program included technical sessions on physical-chemical treatment, nitrogen control, and oxygen aeration. Gerald M. Hansler, Regional Administrator, Region II, gave the opening welcome to the 120-plus consulting engineers and state regulatory personnel in attendance. The oxygen aeration session was introduced into the Technology Transfer Program at this seminar and was well received. A highlight of the seminar was a group tour on March 2 to the Newtown Creek Wastewater Treatment Plant where oxygen aeration is being applied to 20 MGD of wastewater.

Gerald M. Hausler, Regional Administrator, Region II, EPA, welcoming the participants in New York.



PSA (Pressure Swing Adsorption) Oxygen generating unit for 20 mgd oxygen aeration treatment train at Newtown Creek, N.Y. treatment plant.

Mr. Joseph F. Lagnese, President, Water Pollution Control Federation, opened the general discussion session March 2, 1972 (see article on first page).

The Anchorage Seminar included sessions on physical-chemical treatment and cold climate biological waste treatment. A feature of the cold climate biological waste treatment session was a presentation by Mr. Jack Grainge of the Canadian Environmental Protection Service. This session, as with the oxygen aeration session in New York, was included for the first time in the design seminar program.

Feature presentations at the above seminars were given by Swindell-Dressler Company, Pittsburgh, Penna.; Metcalf & Eddy Engineers, Boston, Mass.; Shimek, Roming, Jacobs, & Finklea, Dallas, Texas; CH_2M/Hill, Corvallis, Oregon; and EKONO, Seattle, Wash., with assistance from Jesse M. Cohen, Edwin F. Barth, Sidney A. Hannah, Joseph B. Farrell, and John M. Smith of the EPA National Environmental Research Center in Cincinnati, Ohio.

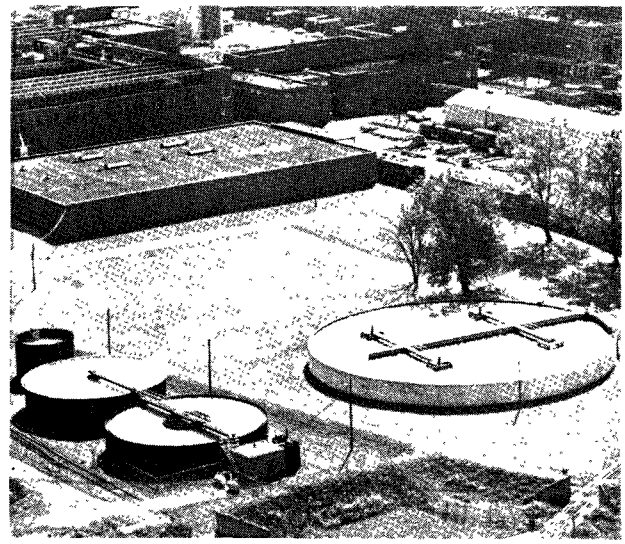
NEW TECHNOLOGY IN USE FOR INDUSTRIAL POLLUTION CONTROL

Following are several examples of the full-scale implementation of new or innovative techniques for the control of industrial sources of pollution. These cases are representatives of what can be accomplished in the way of improved industrial pollution control through the use of presently available technology. More specific information on these projects can be obtained from the Technology Transfer Chairman in the region where the project is located.

AMERICAN ENKA CORP. "Zinc Precipitation and Recovery from Viscose Rayon Wastewater." – Region IV

American Enka, in an EPA Demonstration Project, has won a Finalist Award from the Sports Foundation, Inc. The award, given for achievement in the fight against water pollution, is for a full-scale system for the precipitation and recovery of zinc from the waste stream of their Enka, North Carolina, rayon plant.

In the rayon industry, the zinc originates from the zinc sulfate component of the acid spinning bath, and is carried into the waste stream through yarn washing and filter back-



View of complete wastewater treating facilities at Enka plant, Enka, North Carolina. The large circular tank in the lower middle section represents activated sludge plant, for treatment only of domestic wastes. Zinc recovery system handling process waste water is directly above and slightly to the left of activated sludge plant.

washes. Previously used technology added enough lime to raise the pH to 10.0-11.0, which resulted in a contaminated sludge of low zinc assay. However, the American Enka installation utilizes a new technology in which the waste stream is neutralized with lime to a pH of 6.0, at which point zinc just begins to precipitate. The waste stream is then clarified and the clear solution contracted with a circulating dense slurry of zinc hydroxide precipitate. The pH is raised to 10.0 with sodium hydroxide. The resultant dense sludge settles easily and is 5-7% zinc hydroxide. It is dissolved with acid and reused.

Two thousand pounds of zinc are recovered daily at American Enka at a value of 13.5-14.0 cents/lb. This zinc recovery pays for the cost of the treatment plus a partial amortization of capital expenditures. Approximately 50 million lbs. of zinc sulfate are used annually by the rayon industry. Since the only route for zinc to leave the spinning process is via a waste stream, this amount of zinc has previously been lost to the environment. EPA Project Officer is Edmond Lomasney of Region IV.

VOLVO BRASS AND COPPER CO. "Treatment, Recovery and Reuse of Copper Wire Mill Pickling Wastes" – Region II

The Kenilworth, New Jersey, copper wire plant of the Volvo Brass and Copper Company,

has made an order-of-magnitude reduction in water usage, eliminated chromium, ammonium and fluoride ion discharges, eliminate dumpings of pickling baths, and is recovering copper normally lost in the waste effluent. This EPA Demonstration Project is an excellent sample of how a combination of process improvements can economically make major reductions in plant waste loads. Water usage of the pickling system was reduced from 150 gpm to 10 gpm by the use of a chemical rinse solution to neutralize dragout acid from the pickling bath. The neutralized chemicals from the chemical rinse treatment are then removed by a recycled water rinse. An electrolytic system has been installed to remove copper from the main pickling solution, recovering the copper and regenerating the pickling solution. The third key step is the substitution of hydrogen peroxide as the oxidizing agent in the bright pickle solution, eliminating chromate, fluoride, and ammonium ions as pollutants. The recovery of the copper plus the elimination of operating problems associated with the use of dischromate as an oxidizing agent has resulted in a reduced operating cost, including amortization of the new installation. EPA project officer is John Ciancia of the Edison Water Research Division, Cincinnati NERC.

AMERICAN OIL CO. "Final Purification of Aerated Lagoon Effluent by Chemical Coagulation—Mixed Media Filtration — Region III

An EPA Demonstration Project involving the American Oil Company has been awarded first place in an Environmental Merits Award Program sponsored by *Petroleum Engineer* magazine. The award is for the installation of a mixed-media filtration system for the aerated lagoon effluent at Amoco's Yorktown, Virginia refinery. The filter consists of a concrete tank containing layered anthracite coal, silica sand, and ilemenite. Alum is added to the waste stream pipeline prior to the filter. 1400 gpm of waste water is being treated. EPA Project Officer is Leon Meyers of the Robert S. Kerr Research Center, Ada, Oklahoma.

TECHNOLOGY TRANSFER PARTICIPATES IN CITY MANAGERS' MEETINGS

Technology Transfer participated in the spring meeting of the City Managers' Department League of California Cities in Coronado, California March 9, 1972 and in the Northwest City Managers' Conference in Glenedon Beach, Oregon, March 11. At these meetings, Technology Transfer participated in workshops conducted by Public Technology Inc. aimed at assisting the cities in identifying their needs.

TECHNOLOGY TRANSFER EXHIBITS

The Technology Transfer display booths are available for appropriate conferences and meetings on a request basis. Requests should be made to the Regional Technology Transfer Chairmen (last page of this fact sheet may be used for this purpose). The following is a firm schedule of meetings at which one or more of the exhibits has been or will be displayed.

April 19-21 — National Pollution Control Conference & Exposition
Houston, Texas
Exhibit: Upgrading Existing Wastewater Treatment Plants

May 10-12 — New Jersey Water Pollution Central Association Conference
Attauta City, New Jersey
Exhibit: Physical-Chemical Treatment

May 14-19 — American Industrial Hygiene Conference
San Francisco, California
Exhibit: Phosphorus Removal

June 4-9 — American Water Works Association
92nd Annual Conference
Chicago, Illinois
Exhibit: Analytical Quality Control

July 24-26 — 2nd Urban Technology Conference
San Francisco, California
Exhibit: Phosphorus Removal
Upgrading Existing Wastewater Treatment Plants
Physical-Chemical Treatment
Analytical Quality Control

Sept. 11-14 — International Water Supply Congress
Rockeffer Center, New York

Exhibit: Treating Wastewater

Oct. 8-13 — Water Pollution Control Federation
45th Annual Conference
Atlanta, Georgia

Exhibit: (Under Construction at Present)

TECHNOLOGY TRANSFER MATERIAL AVAILABLE

Listed on the last page of this fact sheet is a current tabulation of available Technology Transfer publications, audio/visual material, and exhibits. By completing this page and forwarding it to the appropriate Regional Technology Transfer Committee Chairman, your request(s) will be filled.

UPGRADING EXISTING TREATMENT PLANTS

The effective transfer of new and/or improved pollution control alternatives is the primary goal of the Technology Transfer Program, and one of the highest priorities of the U. S. Environmental Protection Agency. Incorporation of these technologies in newly designed or constructed facilities is a major step towards solving the pollution problems facing the country today. However, a total solution involves the incorporation of these technologies in existing pollution control facilities.

In the area of domestic sewage far too many of the approximately 12,000 existing sewage treatment plants perform inadequately for one or more of the following reasons: 1) improper plant operation; b) inadequate plant design; c) changes in wastewater flow or characteristics; and d) changes in treatment requirements. Technology is available today to effectively upgrade such facilities to acceptable treatment levels. Detailed discussion of upgrading alternates is contained in the Technology Transfer Process Design Manual for Upgrading Existing Wastewater Treatment Plants, issued October, 1971, and available from the Technology Transfer Program (see last page of this publication). A discussion of the basic technologies involved in upgrading existing sewage treatment plants is presented below.

Since the primary clarifier performance significantly affects the overall effluent quality of existing treatment plants, and since clarification is the most economical way to remove suspended and colloidal pollutants, every effort should be made to improve the primary clarification process before additional facilities are considered.

The technique of adding chemicals to the primary clarifier is an effective upgrading procedure for a secondary plant. The chemicals commonly used in wastewater treatment are the salts of iron and aluminum lime, and synthetic organic polyelectrolytes. The iron (ferrous and ferric) and aluminum salts (sodium aluminate or alum) react with the alkalinity and soluble orthophosphate in wastewater to form precipitates of the respective metallic hydroxides or phosphates. In addition, they destabilize the colloidal particles that would otherwise remain in suspension. These precipitates, along with the destabilized colloids, flocculate and settle readily in a clarifier.

An example of the effect of polyelectrolyte addition (used either alone or in combination with inorganic coagulants) on primary clarifier performance is that, for several plants, the average values of suspended solids and BOD removals were increased from 38 percent and 31 percent to 65 percent and 47 percent, respectively. This indicates that the proper selection and application of polyelectrolytes and chemicals to raw wastewater can significantly improve primary clarifier performance.

Alum, iron, or polyelectrolyte addition, either in the primary or secondary treatment process, can be used advantageously to improve the overall performance of the treatment system, including phosphorus removal. Lime addition may not be feasible for upgrading activated sludge secondary clarifiers because of the potential adverse effect of recirculated lime sludge on mixed liquor microbial characteristics. Lime addition to primary clarifiers may be used, if consideration is given to controlling the pH within acceptable limits for the subsequent processes, and to changes in sludge characteristics and handling requirements. Tube settlers have been used in primary and secondary clarifiers to improve performance as well as to increase throughput in existing clarifiers. The results of several studies indicate that the overflow rates in primary clarifiers can be increased to 5,000 gpd/sq. ft. while producing the same quality effluent as the control unit without the settlers. Tube settlers enhance the ability to capture settleable solids at high overflow rates

because the depth of settling has been reduced to a few inches in the tube. It should be realized that tube settlers do not improve the efficiency of primary clarifiers that are already achieving very high (40-60 percent) removals of suspended solids. Moreover, tube settlers will neither remove colloidal solids that remain in suspension nor induce additional coagulation to effect added particle removal.

The use of effluent polishing of secondary effluent is a relatively new idea which is receiving increasing attention as a practical and economical method of upgrading to obtain increased organic and suspended solids removal from existing treatment facilities. It appears to be particularly applicable in those cases (and there are many) where it is necessary to increase efficiency by an overall amount of 10 to 20 percent in order to meet water quality requirements.

Four unit processes should be considered for effluent polishing: 1) polishing lagoons; 2) microstraining; 3) filtration, including mixed, multi-media, and moving-bed filters; and 4) activated carbon adsorption.

Polishing lagoons offer an opportunity for increased organic and solids removal at a minimum cost. There are two types of polishing lagoons which can be used, aerobic and facultative. Aerobic lagoons are generally subdivided into two groups: 1) shallow lagoons, with depths in the range of 2.5 to 4.0 feet; and 2) deep lagoons, with aeration devices included to insure maintenance of aerobic conditions. Facultative lagoons are characterized by two distinct zones—aerobic and anaerobic. Hydraulic and organic loadings are such that the dissolved oxygen in the lower section of the lagoon is depleted but an aerobic layer is maintained near the surface.

Microstraining has application in effluent polishing chiefly as a method of removing additional suspended solids (and their associated BOD) from wastewater treatment plant effluents. The microstrainer consists of a rotating drum with a peripheral screen. Influent wastewater enters the drum internally and passes radially outward through the screen, with deposition of solids on the inner surface of the drum screen. At the top of the drum pressure jets remove the deposited solids. The backwash water is then collected and returned to the head of the plant. The screens employed in microstrainers have extremely small openings and are made from a variety of metals and plastics. Individual manufacturers have specific designs and sizes for the particular needs of any potential installation.

One of the advantages of using a microstrainer is its low head requirement. It is, therefore, advantageous to transfer secondary effluent, without pumping, to a tertiary microstraining installation in order to minimize the shear forced imparted to the fragile biological floc. Head loss through the microstraining unit, including inlet and outlet structures is about 12 to 18 inches. Across the screen, a 6-inch limit is usually imposed at peak flows. Head losses in excess of this value are prevented by bypass weirs. Head loss build-up is reduced by increasing the rate of drum rotation and by increasing the pressure and flow of the backwashing jets. These adjustments can be made manually or automatically.

Microstrainer installations using 23-micron fabric exhibited average solids removals ranging from 57 to 89 percent while the 35-micron fabric exhibited removals of 55 to 73 percent. In practice, the coarses 35-micron fabric is generally used for the removal of coarse solids.

Historically, sand filtration has not been an efficient method of polishing secondary treatment plant effluent because of low application rates, high head losses, and the need for frequent backwashing. This is largely because the normal backwashing of a sand filter results in a size-graded filter with the finest grains in the upper layers. The resulting stratification removes the bulk of the suspended matter in the upper levels, with a consequent inefficient use of the remaining depth of the filter.

However, developments in mixed, multi-media, and deep-bed coarse-media filters have necessitated a re-evaluation of the role of filtration in effluent polishing. In general, these modifications permit deeper penetration of the media by the suspended and colloidal containments; thus, there is a more effective utilization of the filer depth as compared to conventional sand filters. The increased utilization of filter depth is somewhat offset by the fact that increased backwashing rates and larger quantities of washwater are required to backwash the media properly.

In addition to coarse, mixed, and multi-media filters, a new filtering technique known as a moving-bed filter (MBF) has been developed. The unit is basically a sand filter, but as the filter surface becomes clogged, the filtering

medium is moved forward by means of a hydraulically-actuated mechanical diaphragm. The clogged filter surface is removed mechanically or by gravity, to the extent that a fresh and clean filtering surface is exposed to the incoming chemically treated liquid. The unit is thus a form of countercurrent extraction device which has the capability of functioning on a continuous basis and does not have to be taken off stream for cleaning or backwashing.

The limitations of conventional biological treatment processes in regard to reliable achievement of a high degree of organic removal (particularly of certain compounds which are refractory to biodegradation), along with increasingly strict water quality standards, emphasize the need for a supplementary organic removal process. Thus, activated carbon is presently being used to provide tertiary treatment of biologically treated effluents.

Locations where activated carbon has been used successfully to provide tertiary treatment include: Lake Tahoe, Pomona, and Nassau County. Application at these places clearly indicates the ability of activated carbon to produce effluents with very low levels of organics. At Lake Tahoe, the secondary effluent is treated with lime followed by clarification and mixed-media filtration prior to treatment with the activated carbon; at Pomona, secondary effluent is treated directly in activated carbon columns; in Nassau County, secondary effluent is alum-clarified prior to treatment in activated carbon columns.

There are at least four methods available for the post-aeration of a wastewater treatment plant's effluent. These are: 1) diffused aeration; 2) mechanical aeration; 3) cascade aeration; and 4) U-tube aeration. Most of these devices were initially developed for water treatment and are now being used in the wastewater treatment field.

Of all the types of post-aeration methods, it is likely that mechanical aeration and U-tube aeration will find extensive application in the future. Mechanical aerators are generally grouped in two broad categories: turbine types and pump types. In all types, oxygen transfer occurs through a vortexing action and/or from the interfacial exposure of large volumes of liquid sprayed over the surface. To avoid interference between units, aerator manufacturers recommend a minimum basin size of 15 to 50 feet square and a minimum depth of 5 to 8 feet, depending on the horsepower of the aerator.

The U-tube aerator consists of two basic components: a conduit to provide a vertical U-shaped flow path and a device for entraining air into the stream flow in the down leg of the conduit. The entrainment device is one of two types: 1) aspirator; or 2) compressor and diffuser. In either case, the entrained air is carried along the down leg of the tube because the water velocity exceeds the buoyant rising velocity of the air bubbles. Various design considerations include air-to-water ratio, tube cross-sectional area, and depth. The maximum air-to-water ratio practicable is a function of the velocity through the system. At velocities of approximately 4 fps, 20 percent air-to-water injection requirements for plants of 5 mgd or less should be less than 5 feet. If sufficient head is not available, the flow may be pumped through the U-tube.

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 your appropriate EPA Regional Technology Transfer Committee Chairman from the list below:

REGION	CHAIRMAN	ADDRESS
I	Lester Sutton	Environmental Protection Agency John F. Kennedy Federal Building, Rm. 2304 Boston, Massachusetts 02203 617-223-7210 (Maine, N.H., Vt., Mass., R.I., Conn.)
II	Rocco Ricci	Environmental Protection Agency 26 Federal Plaza New York, New York 10017 201-548-3441 (N.Y., N.J., P.R., V.I.)
III	Warren L. Carter	Environmental Protection Agency 6th & Walnut Philadelphia, Pa. 19106 215-597-9410 (Pa., W. Va., Md., Del.,D.C., Va.)
IV	Asa B. Foster, Jr.	Environmental Protection Agency Suite 300 1421 Peachtree St., N.W. Atlanta, Georgia 30309 404-526-5784 (N.C., S.C., Ky., Tenn., Ga., Ala., Miss., Fla.)
V	Clifford Risely	Environmental Protection Agency 1 N. Wacker Drive Chicago, Illinois 60606 312-353-5756 (Mich., Wis., Minn., Ill., Ind., Ohio)
VI	George Putnicki	Environmental Protection Agency 1600 Patterson Street Suite 1100 Dallas, Texas 75201 214-749-3842 (Texas, Okla., Ark., La., N. Mex.)

REGION	CHAIRMAN	ADDRESS
VII	Lynn Harrington	Environmental Protection Agency 1735 Baltimore Avenue Kansas City, Missouri 64108 816-374-2725 (Kansas, Nebr., Iowa, Mo.)
VIII	Stan Smith	Environmental Protection Agency 1860 Lincoln Street Suite 900 303-837-3961 (Colo., Mont., Wyo., Utah, N.D., S.D.)
IX	Irving Terzich	Environmental Protection Agency 100 California Street San Francisco, Calif. 94111 415-556-7554 (Calif., Nev., Ariz., Hawaii)
X	John E. Osborn	Environmental Protection Agency 1200 6th Avenue Seattle, Washington 98101 206-442-1266 (Wash., Ore., Idaho, Alaska)

REQUEST FOR TECHNOLOGY TRANSFER MATERIAL

Please send me the following publications at no charge and add my name to your mailing list for future Technology Transfer publications. *(Check appropriate boxes)*

PROCESS DESIGN MANUALS

- ☐ Phosphorus Removal
- ☐ Carbon Adsorption
- ☐ Suspended Solids Removal
- ☐ Upgrading Existing Wastewater Treatment Plants

BROCHURES

- ☐ Physical-Chemical Treatment
- ☐ Phosphorus Removal
- ☐ Upgrading Existing Wastewater Treatment Plants
- ☐ Seattle, Washington METRO
- ☐ Wastewater Purification at Lake Tahoe
- ☐ Indian Creek Reservoir

HANDBOOK

- ☐ Analytical Quality Control in Water and Wastewater Laboratories

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Please contact me regarding the loan of the following audio/visual material. *(Check appropriate boxes)*

MOTION PICTURES (16mm sound)

- ☐ Richardson, Texas, Project – Title "Somebody around here must be doing something good." (15 Min.)
- ☐ Phosphorus Removal (5 Min.)

VIDEOTAPE

- ☐ Carbon Adsorption (40 Min.)

Please forward information on the availability of the following Technology Transfer exhibits. *(Check appropriate boxes)*

EXHIBITS

- ☐ Technology Transfer
- ☐ Phosphorus Removal
- ☐ Physical-Chemical Treatment
- ☐ Upgrading Existing Wastewater Treatment Plants
- ☐ Analytical Quality Control

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DESIGN MANUALS TO BE AVAILABLE AT WPCF CONFERENCE

Four design manuals describing the technology used for phosphorus removal, suspended solids removal, activated carbon adsorption, and for upgrading existing municipal wastewater treatment plants will be available to the attendees of the Water Pollution Control Federation's annual conference to be held in San Francisco, Calif., Oct. 3 to Oct. 8, 1971. The design manuals were developed through contracts with various consulting engineering firms, with considerable technical input from the staff of the Environmental Protection Agency's Cincinnati Advanced Waste Treatment Research Laboratory. Contractors for the design manuals were:

Black & Veatch – Phosphorus Removal

Burns & Roe – Suspended Solids Removal

Swindell-Dressler – Activated Carbon Adsorption

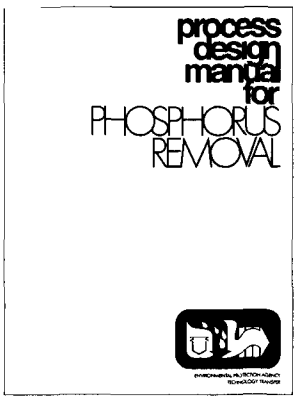
Roy F. Weston – Upgrading Existing Wastewater Treatment Plants

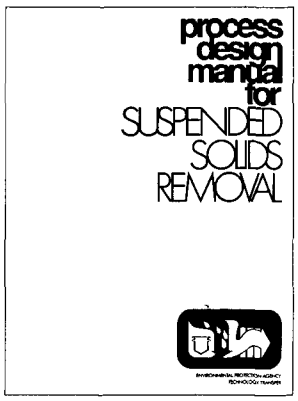
The design manuals can be obtained at no cost at EPA's Technology Transfer exhibit center in Brooks Hall of the Civic Auditorium. The exhibit will feature specially built displays of flow diagrams illustrating Physical-Chemical Treatment, Phosphorus Removal, and Upgrading Existing Wastewater Plants. Additional displays on Storm and Combined Sewers, and Federal-State programs will also be part of EPA's Technology Transfer exhibit.

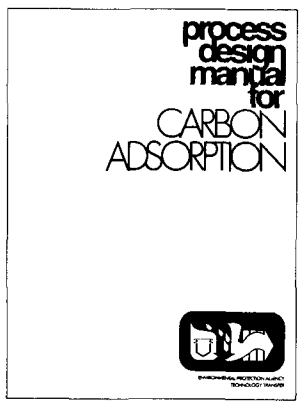
These design manuals provide detailed information on new treatment processes and techniques, along with their associated costs. Information is included on manpower requirements; case histories of municipalities using these new processes are also cited. It is felt that if engineers utilize the recommendations contained in these manuals when designing new or upgrading existing waste treatment facilities, a major impact can be made on improving the quality of wastewater treatment. In addition, the manuals will provide guidance to engineers so that they will be able to advise municipalities on the best methods to meet present and future water quality standards.

For those engineers who are unable to attend the WPCF annual conference, the design manuals will be available free of charge through the Technology Transfer committee located in their region. The names and addresses of the regional committee chairmen are listed at the end of this fact sheet.

Covers of Design Manuals







Additional design manuals on physical-chemical treatment, nitrogen removal, and sewer system corrosion control are planned for 1972 as part of a continuing series to transfer new technology as soon as it becomes available. All the design manuals will be constantly updated as appropriate.

DESIGN SEMINAR PROGRAM CONTINUES

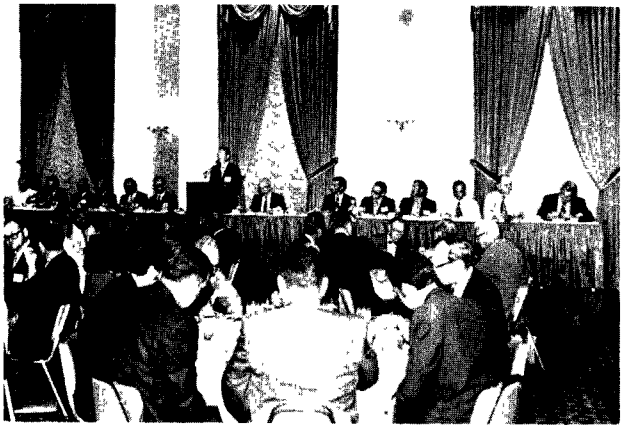
The Technology Transfer design seminar program continued its tour through Charlottesville, Va., on June 8 and 9, and Dallas, Tex., on July 27 and 28, 1971. These seminars, planned to transfer new research findings to consultant, State, and local design engineers, included a first half-day session covering the EPA construction grants program and Federal Guidelines for Design, Operation, and Maintenance of Wastewater Treatment Facilities. Attendees were then divided into three groups, with each group participating in a separate technology subject area that had been selected to answer the specific needs of the region. The attendees received detailed half-day sessions on each specific subject. Each session included a brief summary of the specific problem and a technical discussion by a leading authority in the field, followed by a case history of a municipality using this new technology.

The Charlottesville, Va., seminar included sessions on phosphorus removal, nitrogen removal, and the use of activated carbon for increased organics removal. Feature presentations were given by Mr. James Laughlin of Shrimek, Roming, Jacobs & Finklea, consulting engineers on phosphorus removal; Dr. Clair Sawyer of Metcalf & Eddy, consulting engineers on nitrogen removal; and Mr. C. Donald Wood of Swindell-Dressler Co., on the use of activated carbon for increased organics removal. In addition, each session included a presentation summarizing the specific problem presented by a representative from EPA's Cincinnati Advanced

Working session at Dallas Seminar being addressed by Dr. Irwin Kugelman from EPA's Advanced Waste Treatment Laboratory

Russell Culp addressing session on media filtration and carbon adsorption

Albert C. Trakowski, Deputy Assistant Administrator for Program Review, Office of Research & Monitoring, being introduced as speaker at Dallas Seminar luncheon



Waste Treatment Research Laboratory. Case histories of municipalities using this new technology were also presented. The examples cited were: Rocky River, Ohio, for activated carbon; the District of Columbia for nitrogen removal; and Piscataway, Md., for phosphorus removal.

The Dallas seminar followed the same general pattern for these meetings, with technology presented on phosphorus removal, nitrogen removal, and media filtration and carbon treatment. The sessions included presentations from the following consulting engineers: Metcalf & Eddy; Shimek, Roming, Jacobs & Finklea; and Forest & Cotton. A highlight of the session on media filtration and carbon treatment was the presentation by Mr. Russell Culp, South Lake Tahoe, Calif.

VIDEO TAPES NOW AVAILABLE AT EPA REGIONS

The Technology Transfer Program is preparing an entire series of video tapes on wastewater treatment process systems and techniques. Each tape is presented by a leading authority in that particular field. The first of this series, which is now available, features Arthur Masse, Chief of the Municipal Pollution Research Program of the Advanced Waste Treatment Research Laboratory in Cincinnati, Ohio. Mr. Masse presents a technical discussion on activated carbon adsorption. Other video tapes are being prepared and will feature such subjects as phosphorus removal, upgrading existing treatment plants, oxygen aeration, and nitrogen removal.

EPA TECHNOLOGY TRANSFER BOOTHS TO BE A FEATURE AT ST. LOUIS

The Annual Environmental meeting of the American Society of Civil Engineers (ASCE) will show the latest technology developments in the wastewater field with the EPA display booths. This show will essentially be the same as the one being introduced by EPA at the Water Pollution Control Federation annual meeting in San Francisco. Attendees of the ASCE meeting will have the opportunity to sign up for the new design manuals.

FROM THE REGIONS – NEW TECHNOLOGY IN USE

Following are several brief reports submitted by EPA's regional offices describing a few of the successful projects which have been supported by the Research and Monitoring Program of the Environmental Protection Agency, or which have been implemented as a result of new technology developed and demonstrated by EPA's Research Program. Specific information concerning individual projects may be obtained from the Technology Transfer committee in the region where the project is located.

METRO SEATTLE, WASH. "Park Development With Wet Digested Sludge" – Region X

Ultimate disposal of digested sludge is one of the more difficult problems associated with wastewater treatment. In July 1968, the community of Seattle embarked on a program to investigate and demonstrate the feasibility of utilizing digested wet wastewater sludge as a landfill material. The following requirements were established for the sludge: it must have proper settling characteristics; be capable of reducing its high water content; exhibit no undesirable interactions with underlying soil layers; and possess acceptable structural characteristics. This four-year study has examined all the above requirements and found that the digested wet wastewater sludge could provide adequate landfill material. METRO began actual fill operations this summer as a means of developing an urban recreational park land by filling an intertidal test area. This project is scheduled for completion in July 1972.

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO. "Hanover Tertiary Plant Studies" – Region IV

In 1965, the Board of Directors of the District decided to devote one of their sewage treatment facilities to developing advanced waste treatment techniques for application to pollution control requirements throughout the District. The Hanover Plant was selected for this purpose. A 1-million-gallon-per-day (mgd) microstrainer system was placed in operation in parallel with a 1 mgd rapid sand filter system to evaluate effluent pollution procedures. The effluent biochemical oxygen demand of an average of 17.5 milligrams per liter (mg/l) has been reduced to an average of 3 mg/l while suspended solids have been reduced from 12 mg/l to 5 mg/l.

The microstrainer occupies about 1/20th the space of a rapid sand filter plant and costs about

1/10th as much. The microstrainer has been found to be highly reliable and provides low operating costs.

While this microstrainer is believed to be the first of its size and type in this country providing tertiary treatment, it will soon be joined by a larger unit now under construction by the District at their Northside Plant. The new system will have 15 mgd capacity.

CITY OF MARLBOROUGH, MASS. "Use of Metal Salts for Phosphorus Removal" – Region I

The City of Marlborough, Mass., is currently having final plans and specifications prepared for a two-stage activated sludge wastewater treatment facility with a design capacity of 5.5 mgd. Phosphorus is to be removed by the addition of a metal salt to the effluent of the first-stage aeration tanks. This plant will replace an existing high-rate trickling filter plant which discharges its effluent to a string of several small ponds and brooks before discharging into the main water course. The use of existing trickling filters for such treatment was eliminated because of odor problems, adverse effects of cold weather, and the need to maintain the quality of the effluent as high as possible. Metcalf & Eddy Engineers, Inc., of Boston are designing the facilities. Results of preliminary studies on this facility along with Metcalf & Eddy's experience on phosphorus removal were presented at the Technology Transfer Design Seminar held in Boston on May 26 and 27, 1971.

ROY WESTON, INC., "Design, Construction and Operation of a Transportable Advanced Waste Treatment Facility" – Region III

Through a contract with Roy Weston, Inc., a relocatable wastewater treatment facility that is designed to handle 75,000 gallons of wastewater per day has been constructed and erected in Fairfax County, Va. The purpose of this facility is to provide an interim treatment system for new subdivisions until the subdivision can tie into the centralized treatment system. The unit will then be relocated at another developing subdivision so that homebuilding will not be delayed because of inadequate waste treatment systems. The treatment scheme utilizes flow equilization, ferric chloride addition to primary clarifiers for phosphorus removal, aeration, biological denitrification, multimedia filtration, and chlorination. The goals of this facility are to achieve the proposed Potomac River effluent standards for 1976, which are:

Biochemical Oxygen Demand –
0.04 lb/1,000 gal/day
Phosphorus – 0.0017 lb/1,000 gal/day
Nitrogen – 0.008 lb/1,000 gal/day

Start-up operations began this summer. Plans are for the County of Fairfax to take over plant operation in the fall of 1971. After operating the plant for one year, and if funds are available, it is planned to relocate the treatment facility within Fairfax County.

YOUR LOCAL REGIONAL TECHNOLOGY TRANSFER COMMITTEEMEN ARE LISTED ON THE NEXT TWO PAGES .....

WHERE TO GET FURTHER INFORMATION

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II	Rocco Ricci	(N.Y., N.J.) Environmental Protection Agency 26 Federal Plaza New York, N.Y. 10017 212-264-2525
III	Warren L. Carter	(Pa., W.Va., Me., Va., Del.) Environmental Protection Agency P.O. Box 12900 Philadelphia, Pa. 19108 215-597-9151
IV	Asa B. Foster, Jr.	(N.C., S.C., Ky., Tenn., Ga., Ala., Miss., Fla.) Environmental Protection Agency Suite 300 1421 Peachtree St., N.E. Atlanta, Ga. 30309 404-526-5784
V	Clarence Laskowski	(Mich., Wis., Minn. Ill., Ind., Ohio) Environmental Protection Agency 33 East Congress Pkwy. Chicago, Ill. 60605 312-353-1056
VI	George Putnicki	(Tex., Okla., Ark., La., N. Mex.) Environmental Protection Agency 1114 Commerce Street Dallas, Texas 75202 214-749-1821
VII	John R. Burgeson	(Kansas, Nebr., Iowa, Mo.) Environmental Protection Agency 911 Walnut Street Kansas City, Mo. 64106 816-374-5616

VIII	Chris Timm	(Mont., Wyo., N.Dak., S.Dak., Colo., Utah) Environmental Protection Agency Federal Office Bldg. 19th and Stout Streets Denver, Colo. 80202 303-233-2336
IX	John Merrell	(Calif., Nev., Ariz.) Environmental Protection Agency 760 Market Street San Francisco, Calif. 94102 415-556-5876
X	John F. Osborn	(Wash., Ore., Idaho, Alaska) Environmental Protection Agency Pittock Block 921 S.W. Washington Street Portland, Ore. 97205 503-226-3914

GPO 918-183

July 1
1971

TECHNOLOGY TRANSFER

The Bridge Between Research and Use

ENVIRONMENTAL PROTECTION AGENCY

EPA BOOTH ON THE MOVE

The EPA Technology Transfer Display Booth is on the road again. Leaving Washington the end of May, it made quite an impression at the American Chemical Society Regional meeting at the University of Cincinnati, Ohio, from June 6 through the 8th. From here it is scheduled for the Ohio State Fair in Columbus, Ohio, where it will be displayed as part of the Ohio Department of Natural Resources. The fair, one of the country's largest, is held during the latter part of August. Below is a black and white photo of the attractive moving color lighted booth. This display available upon request, subject to prior booking.

MORE BOOTHS ON THE WAY

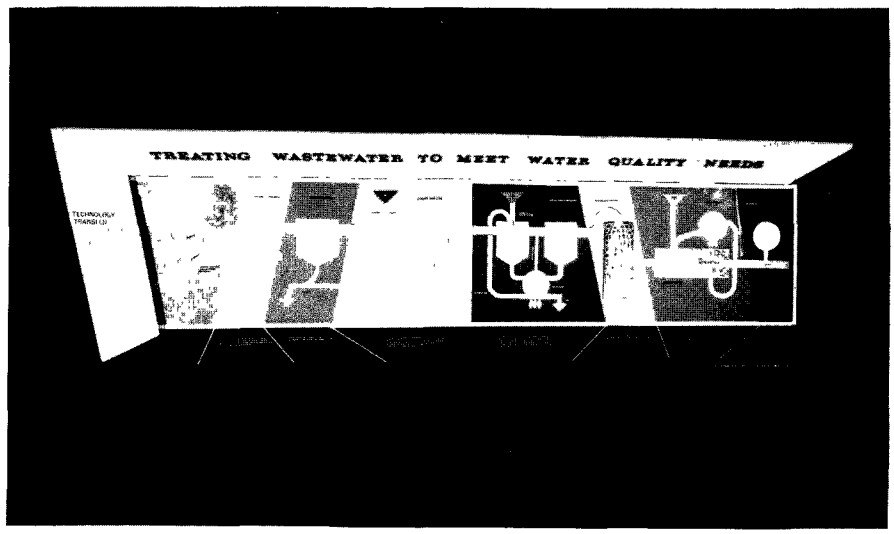
The Technology Transfer Program of the EPA is having a series of three new large displays constructed, illustrating modern technology as applied to new or existing wastewater treatment plants. Among the subjects to be covered are: Physical-Chemical treatment; Phosphorus Removal; and Upgrading Existing Plants. Premiere will be at WPCF Annual Conference in October at San Francisco.

DESIGN SEMINARS HIGHLY REGARDED

Critiques of this series indicate all attending found the sessions very helpful. Technology Transfer design seminars for wastewater treatment facilities were conducted, during the second quarter of the year in Cleveland, Ohio, and Boston, Mass.

These were the second and third seminars respectively, in a series that will be presented by the Environmental Protection Agency Technology Transfer Program during the coming three years. The seminars were oriented towards State, municipal, and consulting engineers involved in design of wastewater treatment facilities. Each of the seminars included a half-day general session covering the EPA construction grants program and the Federal Guidelines for Design, Operation and Maintenance of Wastewater Treatment Facilities. The attendees were then divided into three groups with each group attending three half-day sessions, each covering a separate technology subject area.

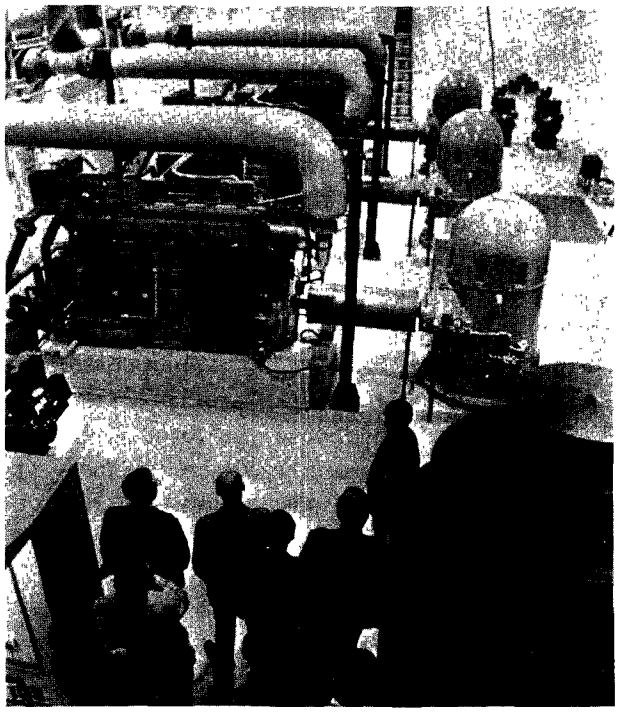
The Cleveland seminar (April 22-23) included sessions on phosphorus removal, activated carbon adsorption, and nitrogen removal. The basic presentations at each session were given by



prominent qualified consulting engineers: phosphorus removal by Mr. James Laughlin of Shimek, Roming, Jacobs & Finklea; activated carbon adsorption by Dr. Joseph Skelly of Swindell-Dressler; and nitrogen removal by Dr. Claire Sawyer of Metcalf & Eddy. Each session also included a presentation by a representative of the EPA Advanced Waste Treatment Research Laboratory in Cincinnati, and an analysis of a specific project incorporating the subject technology. The projects analyzed were Grand Rapids, Michigan, for phosphorus removal, Rocky River, Ohio, for activated carbon, and the District of Columbia for nitrogen removal.

The Boston seminar (May 26-27) used the same general format as described for Cleveland. The three technology subject areas were phosphorus removal, upgrading existing treatment plants, and combined sewer overflows. Basic

Metropolitan District Commission, Storm Detention and Chlorination.



presentations were by representatives from Roy F. Weston and Metcalf & Eddy with additional information once again presented by representatives from EPA. The combined sewer overflow regulation and infiltration control by Mr. Richard Sullivan of the American Public Works Association, and a field trip to the combined sewer overflow detention and chlorination station near the Boston University Bridge an EPA demonstration grant project. The BU Bridge project, with a capacity of 233 mgd, was an impressive example of new technology being applied on a practical full-scale basis. Future seminars will also include visits to operating projects whenever possible.

A fourth seminar will be conducted June 8-9 in Charlottesville, Virginia. Details of the Charlottesville sessions plus others held during the coming three months will be included in the next newsletter. (A sample program follows on page 3.)

Dr. Clair N. Sawyer of Metcalf & Eddy at the Statler Building, Boston, Massachusetts.

Combined Sewers Workshop.

ENVIRONMENTAL PROTECTION AGENCY

Technology Transfer Program

DESIGN SEMINAR

for

Waste Water Treatment Facilities

MAY 26-27, 1971

PARKER HOUSE
60 SCHOOL STREET
BOSTON, MASSACHUSETTS

WEDNESDAY, MAY 26, 1971

8:00 - 9:00 AM
REGISTRATION

9:00 AM
WELCOME
Lester M. Klashman, Regional Director
Environmental Protection Agency

9:05 AM
EPA's TECHNOLOGY TRANSFER PROGRAM
Herbert R. Pahren, Deputy Regional Director
Environmental Protection Agency

9:20 AM
THE FEDERAL-STATE EFFORT.
NEW TECHNIQUES TO MEET WATER QUALITY STANDARDS
Thomas C. McMahon, Director
Massachusetts Division of Water Pollution Control

9:40 AM
COFFEE BREAK

10:00 AM
EPA's CONSTRUCTION GRANTS PROGRAM
Federal Design Guidelines; Regulations and Policies
Lester A. Sutton, Director
Facilities Programs
Environmental Protection Agency

11:30 AM
ASSIGNMENT OF GROUPS FOR WORKSHOP SESSIONS
Groups A, B and C

11:45 AM
LUNCH

1:00 - 5:00 PM
WORKSHOPS

6:00 PM
RECEPTION (Ladies Welcome)

7:00 PM
DINNER (Ladies Welcome)

SPEAKER: Joseph B. Hanlon, Vice President
Camp, Dresser & McKee
Consulting Engineers

THURSDAY, MAY 27, 1971

8:30 AM - 12:15 PM
WORKSHOPS

12:15 PM - 1:15 PM
LUNCH

1:15 PM - 5:00 PM
WORKSHOPS

WORKSHOPS SCHEDULE

WEDNESDAY, MAY 26, 1971 PM
THURSDAY, MAY 27, 1971 (AM) (PM)

COMBINED SEWER OVERFLOWS

HAWTHORNE ROOM

GROUP A	Wednesday	PM
GROUP B	Thursday	AM
GROUP C	Thursday	PM

1:00 PM - (8:30 AM) - (1:15 PM)
CURRENT STATUS ON CONTROL AND TREATMENT OF STORM AND COMBINED SEWER OVERFLOWS.
Edmund J. Struzeski, Chief
Storm and Combined Sewer Overflows Section
Edison Water Quality Laboratory
Environmental Protection Agency
Edison, New Jersey

1:25 PM - (8:55 AM) - (1:40 PM)
OVERFLOW REGULATORS - INFILTRATION CONTROL.
Richard H. Sullivan, Assistant Executive Director
American Public Works Association
Chicago, Illinois

2:25 PM - (9:55 AM) - (2:40 PM)
METROPOLITAN DISTRICT COMMISSION COMBINED SEWER OVERFLOW DETENTION AND CHLORINATION STATION.
K. Peter Devenis, Vice President
Charles A. Maguire & Associates Inc.
Boston, Massachusetts

2:45 PM - 5:00 PM
(10:15 AM - 12:15 PM) - (3:00 PM - 5:00 PM)
FIELD TRIP TO MDC STATION
Francis T. Bergin, Chief Engineer
Boston, Massachusetts

UPGRADING OF EXISTING WASTE WATER TREATMENT PLANTS

ROOM 164-166

GROUP A	Thursday	AM
GROUP B	Thursday	PM
GROUP C	Wednesday	PM

1:00 PM - (8:30 AM) - (1:15 PM)
INTRODUCTION
John M. Smith
Advanced Waste Treatment Research Laboratory
Environmental Protection Agency
Cincinnati, Ohio

1:20 PM - (8:50 AM) - (1:35 PM)
STATE OF THE ART
Roy F. Weston, Inc.
West Chester, Pennsylvania

3:10 PM - (10:40 AM) - (3:25 PM)
COFFEE BREAK

3:25 PM - (10:55 AM) - (3:40 PM)
UPGRADING OF ACTIVATED SLUDGE PLANTS
Alfred W. West
Field Investigations Division
Environmental Protection Agency
Cincinnati, Ohio

4:15 PM - (11:45 AM) - (4:30 PM)
DISCUSSION

PHOSPHORUS REMOVAL

ROOM 160-162

GROUP A	Thursday PM
GROUP B	Wednesday PM
GROUP C	Thursday PM

1:00 PM - (8:30 AM) - (1:15 PM)
STATE OF THE ART
Clair N. Sawyer, Vice-President and Director of Research
Metcalf & Eddy, Inc.
Boston, Massachusetts

2:00 PM - (9:30 AM) - (2:15 PM)
GENERAL INFORMATION ON PHOSPHORUS REMOVAL
Advanced Waste Treatment Research Laboratory
Environmental Protection Agency
Cincinnati, Ohio

2:45 PM - (10:15 AM) - (3:00 PM)
COFFEE BREAK

3:00 PM - (10:30 AM) - (3:15 PM)
THE MARLBOROUGH WASTE WATER TREATMENT PLANT
David A. Duncan, Vice President
Frank C. Sampson, Project Engineer
Metcalf & Eddy, Inc.
Boston, Massachusetts

4:15 PM - (11:45 AM) - (4:30 PM)
DISCUSSION

PHYSICAL CHEMICAL TREATMENT

As water quality standards become more stringent, cities and communities across the country are being faced with the problem of upgrading existing wastewater treatment facilities, and some are having to decide whether to build additional facilities or completely new facilities. To arrive at a responsible decision, based on practical technology and the economics involved, decision makers, planners and engineers must look at all available new technology and possibilities of alternate solutions to the problem.

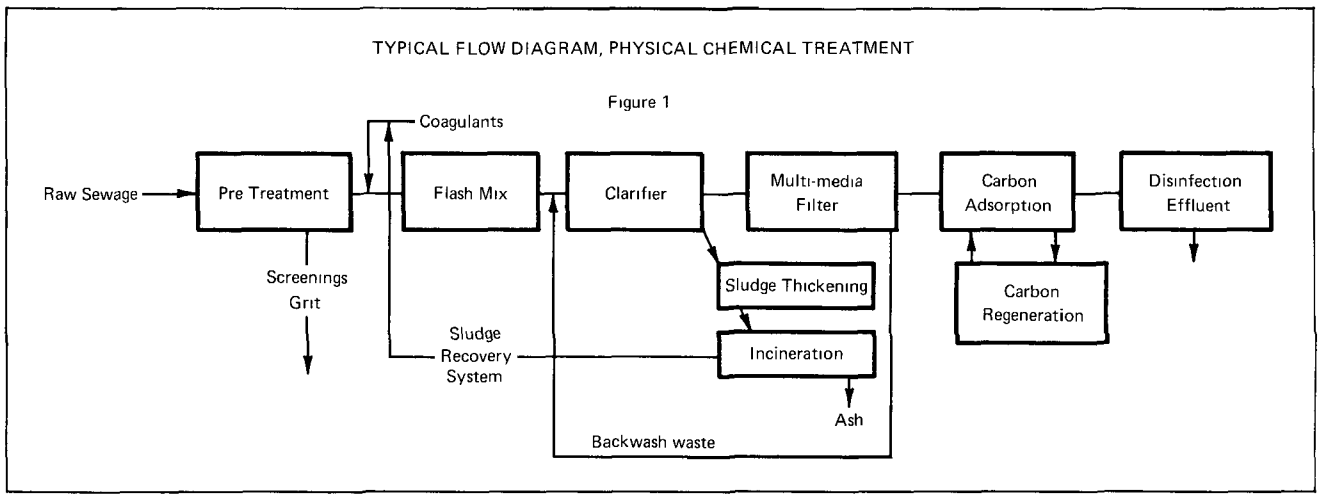
It has become apparent that conventional biological treatment systems do not provide the best solution to all wastewater problems, especially when more stringent water quality standards continue to be applied. One of the new technologies is the independent PHYSICAL-CHEMICAL TREATMENT PROCESS. This process is an alternate to conventional biological treatment that is particularily attractive when high levels of treatment, including phosphorus and other nutrient removal is required and land area is limited. The physical-chemical process does not utilize bacteria, but rather chemicals are used to facilitate removal of most of the nutrients and solids. In this process, following clarification in the physical-chemical treatment sequence, granular carbon and multi-media filtration are used to remove colloidal and dissolved materials through adsorption and filtration. A typical flow diagram of an independent physical-chemical (IPC) treatment system is shown. However, unit process making up this IPC can be utilized in existing plants.

Components of the P-C treatment system includes:

Pre-Treatment—Preliminary screening and settling of floating debris, sand, grit, and other large particles.

Clarification—This unit process is known as coagulation-sedimentation. In this process alum, lime or ferric salts and in some cases poly-

FIGURE 1



electrolytes are added to the sewage as it comes from the pre-treatment unit. The sewage passes through a flash mix system into a flocculation zone where the chemicals cause the smaller particles to floc together into masses that settle easily. The clarifier may be of either horizontal flow or up flow design.

Filtration—This unit process consists of passing the treated sewage through beds of sand, or multimedia such as sand and anthracite coal for complete removal of the suspended solids.

This unit process can be ahead of, or behind the adsorption unit according to design and treatment objectives.

Adsorption—This unit process removes the colloidal organic and some of the dissolved organic solids which cannot be removed by the clarification and filtration stages. The adsorption process consists of passing the treated wastewater through a bed of activated carbon granules. When the partially treated wastewater comes into contact with the carbon, the organics attach themselves to the surface of the carbon granules and thus are removed from the stream. After a period of time, the carbon becomes laden with organics and must be regenerated to again become active and remove the organics. Regeneration consists of burning off the adsorbed sewage organic carbon under controlled conditions without seriously altering the basic activated carbon granules.

Disinfection—This unit process is utilized to destroy pathogenic organisms and normally employs chlorine with a contact chamber to provide detention time for adequate removal.

The treatment performance of various sewage treatment systems is shown in Table 1. It can be seen that the physical-chemical methods removal are better than conventional methods of treatment, for removal of both organics and phosphorus.

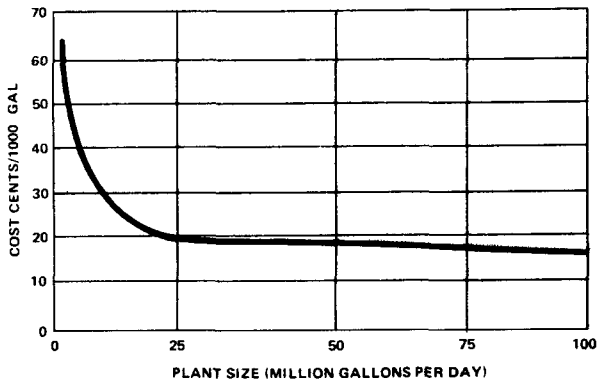
TABLE 1
Treatment Performance
Sewage Treatment Systems

	Removal Efficiency	
Process Train	**Organics**	**Phosphorus**
Biological	85-95	25-40
Biological-Chemical	85-95	35-90
Physical-Chemical	95-99	85-99

COSTS

Physical-chemical treatment undoubtedly costs more than conventional treatment but the systems cannot be compared directly, as one provides a level of treatment that the other cannot match. The chart in Figure 2 below shows the approximate national average costs, including plant amortization and operation and maintenance for typical physical-chemical treatment plants. The graph in Figure 2 is a general guide and is subject to considerable variation due to geographic locations, labor rates, and site conditions.

FIGURE 2



The approximate capital and Operation and Maintenance costs for a 50 million gallon per day physical-chemical treatment plant are shown in Table 2.

The 50 mgd physical-chemical treatment plant example presented in Table 2 is based on a lime process, but utilization of other coagulants, such as ferric salts, alum and other aluminum salts should also be considered. In some cases, the other coagulants may be preferred over lime.

The foregoing has assumed new construction, or an existing plant that may easily be converted to independent physical-chemical treatment. The use of any or all of the unit processes in conjunction with existing biological secondary treatment plants (tertiary treatment) certainly should be considered as an alternate when plant upgrading becomes necessary and a biological treatment plant exists.

P-C is Ready Now!

Technology for design, construction and operation of physical-chemical treatment plants that will provide high quality effluents is considered to be well developed and ready for widespread application. The following table is a partial list of full-scale and pilot plants now being planned, designed, constructed, or in operation.

Location IPC	Size (MGD)
Niagara Falls, New York	60
Garland, Texas	30
Fitchburg, Mass.	15
Rocky River, Ohio	10
Cleveland, Ohio	50
Cortland, New York	10
Owasso, Michigan	6
Painesville, Ohio	5
Tertiary	
South Lake Tahoe, Calif.	7.5
Piscataway, Maryland	25
Colorado Springs, Colorado	2
Santee, Calif.	2
Hobbs, New Mexico	5
Hatfield Township, Penn.	5
Large Scale Pilot Facilities	
Blue Plains, Wash. D. C.	
Salt Lake City, Utah, EIMCO	
Rocky River, Ohio	

NIAGARA FALLS, N.Y.: The design for a new 61.9 MGD physical-chemical treatment plant for this municipality is progressing on schedule. According to the Consulting Engineers on the

TABLE 2
Physical-Chemical 50
MGD System Estimated Costs**

Process	Capital Millions of $	Amortization ¢/1000 gal	Operation & Maintenance	Total
Pre-Treatment	$ 412,000	0.15	0.29	0.44
Lime Coagulation & Recalcination	6,200,000	4.20	2.70	2.02
Filtration	1,850,000	0.75	1.26	6.90
Carbon Adsorption	9,350,000	4.20	5.60	9.80
Disinfection	280,000	0.14	0.37	0.51
Total	18,092,000	9.45	10.22	19.67

**Based on November, 1970 Costs

project, Camp, Dresser & McKee of Boston, this type of treatment was selected by Niagara Falls because of the large concentrations of industrial wastes found in the city's wastewater streams to the treatment plant. The wastes were of such nature and toxicity that it would have been impossible to treat in the conventional biological system.

ROCKY RIVER, OHIO: The current status of the Rocky River Wastewater Plant, Cuyahoga County, Ohio, is that plans and specifications have been revised and are now ready for a public hearing. The city is presently negotiating with the State of Ohio for additional funds. The project is ready to go out for bids.

The new plant will demonstrate physical-chemical treatment at a scale 10 MGD. Conventional biological activated sludge treatment will not be used. Polymer flocculants will be used for chemical clarification; phosphate removal will be effected by use of various coagulants and coagulant aids. The primary clarified effluent will be passed through columns of activated carbon for filtration of suspended solids and adsorption of organic pollutants.

GARLAND, TEXAS: Typical of many other cities throughout the country today, Garland is faced with the necessity of expanding it's wastewater treatment facilities. It is necessary to expand the plant to a hydraulic capacity of 30 million gallons per day and to provide treatment capabilities for reducing both the BOD and suspended solids to a concentration of less than 10 mg/l.

To meet these objectives the physical-chemical treatment process has been selected. The City of Garland was influenced further toward adoption of this type of treatment because the plant would only require about 30% of the land required by conventional treatment plants and would provide superior treatment as well. As a result of the superior effluent available from the new plant the community anticipates that the effluent will be utilized by industry.

TUALATIN, OREGON: The City of Tualatin is situated on a small tributary of the Willamette River and water quality requirements are understandably high. To meet these requirements, the city of Tualatin decided to provide tertiary treatment in a rather unconventional manner. An aerated lagoon provides biological secondary treatment and it is followed by a tertiary system that incorporates flocculation, settling basin, filtration and chlorination. The tertiary system is operated during the critical six months of low stream flow, and secondary treatment is provided for the remainder of the year. Alum is being used as a coagulant.

PAINESVILLE, OHIO: The community has industrial waste contributions including effluents from oil additive and chemical producers that result in a combined waste that is difficult to treat biologically. The new 5 mgd plant will utilize chemical coagulation and clarification, coarse sand filtration, granular carbon adsorption and regeneration, and chlorination. The city is presently negotiating for additional funds and is ready to go out for bids.

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III	Warren L. Carter	(Pa., W. Va., Md., Va., Delaware) Environmental Protection Agency P.O. Box 12900 Philadelphia, Pa. 19108 703-296-1275
IV	Asa G. Foster	(N.C., S.C., Ky., Tenn., Ga., Ala., Miss., Fla.) Environmental Protection Agency Suite 300 1421 Peachtree St., N.E. Atlanta, Ga. 30309 404-526-5784
V	Clarence Laskowski	(Mich., Wis., Minn., Ill., Ind., Ohio) Environmental Protection Agency 33 East Congress Pkwy. Chicago, Ill. 60605 312-353-1056
VI	George Putnicki	(Texas, Okla., Ark., La., N. Mex.) Environmental Protection Agency 1114 Commerce Street Dallas, Texas 75202 214-749-1821

Region	Chairman	States Covered and Addresses
VII	John R. Burgeson	(Kansas, Nebraska, Iowa, Mo.) Environmental Protection Agency 911 Walnut Street Kansas City, Missouri 64106 816-374-5593
VIII	Chris Timm	(Mont., Wyo., N. Dak., S. Dak., Colo., Utah) Environmental Protection Agency Federal Office Bldg. 19th and Stout Streets Denver, Colorado 80202 303-233-2336
IX	John Merrell	(Calif., Nev., Ariz.) Environmental Protection Agency 760 Market Street San Francisco, California 94102 415-556-5876
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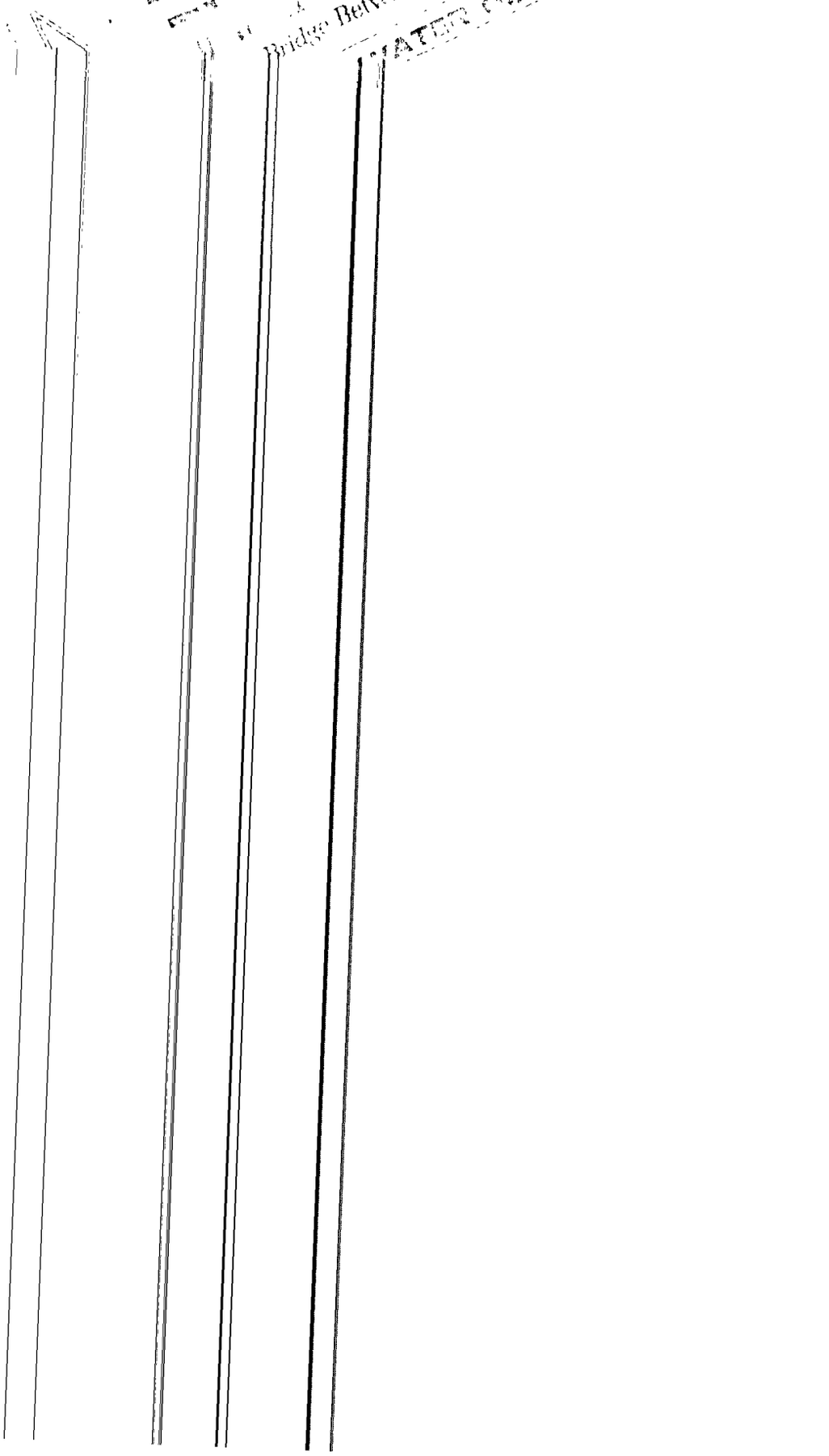
WATER CULTURE PRACTICE



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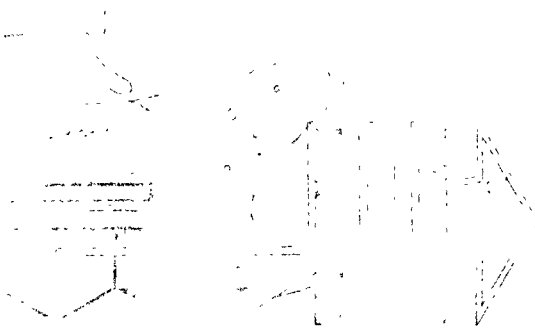

The Bridge Between Research and Use

ENVIRONMENTAL PROTECTION AGENCY • WATER QUALITY OFFICE

THE TECHNOLOGY TRANSFER NEWSLETTER

This is the first issue of the Technology Transfer Newsletter. The early issues of the Newsletter are now planned for internal EPA circulation to familiarize appropriate personnel with the Technology Transfer Program. Later issues will be widely circulated outside of the EPA organization. The plan at this time is to feature one aspect of advanced technology per issue to have maximum impact. Additional features, such as summarized fact sheets, and brief highlights of current water pollution control technology will be added. Input and suggestions from all Regions are encouraged.

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WHAT IS TECHNOLOGY TRANSFER?

In the past, there has been a gap between the development and technical demonstration of our agency's research, development and demonstration results, and their actual acceptance and implementation. . The goal of Technology Transfer is to bridge this gap. The initial effort will be to transfer advances in technology demonstrated by successful research demonstration projects into the current generation of waste treatment facilities. Our first goal will be to have the maximum impact upon the President's multi-billion dollar program for construction of treatment facilities, including combined sewage, in order to meet present Water Quality Standards by 1976.

Detailed plans are being formulated for the technology transfer program. Following is a summary of some of our tentative plans:

1. A series of technical seminar/workshops will be conducted which will be orientated toward municipal, State, and private consulting engineers emphasizing the practical application of new technology, i.e., design criteria and parameters, capital and operating costs, results of research demonstrations, experience, and problems. One seminar is tentatively planned for each region in 1971.

2. A series of administrative seminar/workshops will be held which will be oriented toward administrative decision-makers in the water pollution control field (e.g., directors of public works, heads of municipal and State water pollution control agencies, city council members, etc.). These workshops will be aimed at convincing responsible administrators that new technology is available for full scale application and can be effectively and efficiently used to meet water quality standards. Both the technical and administrative seminar/workshops will be slanted toward the specific technology needs of each region.

3. Design manuals on suspended solids removal, activated carbon adsorption, phosphorus removal, and upgrading of secondary treatment will be completed in 1971 and incorporated into seminar/workshops.

4. Technical bulletins will be issued to supplement the Federal Design Guidelines published in October 1970. Successful Research and Development demonstration grant projects, located throughout the country, will be exploited to show actual implementation of advanced technology and transfer the experience gained at these projects.

5. A campaign will be initiated to reach conservation groups and the general public.

The Technology Transfer Program planning and implementation will be basically administered by a Headquarters Working Committee, and Regional Working Committees, comprised of representatives from R&D, Facilities Construction and Operations, Manpower Training, and Public Affairs. The Regional Working Committees will insure that the program will meet their specific regional needs. In addition, an advisory board has been appointed to review the program and assist in the overall direction.

TECHNOLOGY TRANSFER ACTION GROUPS

The technology transfer action groups have been selected and members are available for obtaining information on the program. The committees are as follows:

TECHNOLOGY TRANSFER ADVISORY BOARD

Robert E. Crowe - (Exec. Sec.), HQ WQO
John M. Rademacher, Interim Regional Coordinator, Region VII
Francis Mayo, Interim Regional Coordinator, Region V
Paul DeFalco, Interim Regional Coordinator, Region IX
Frank Middleton, Dir., Advanced Waste Treatment Research Lab.
Thomas J. Charlton, HQ WQO
Ralph Palange, HQ WQO, Facilities Const. & Oprs.

HEADQUARTERS WORKING COMMITTEE

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Denis Lussier - Facilities Const. & Opers.
Kenneth Hay - Manpower Training
Arthur Daitch - Public Affairs
Patrick Tobin - Research and Development

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Ray Thacker - Research and Development
Charles F. Kauffman - Manpower Training
James D. Bowyer - Public Affairs

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Chester Shura - Manpower Training
Frank Corrado - Public Affairs

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Lyman Neilson - Manpower Training

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Harold Jeter - Manpower Training
Keith O. Schwab - Tech. Programs

Missouri Basin

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John L. Coakley - Manpower Training
Randall S. Jessee - Public Affairs

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Charles Pou - Public Affairs

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Dick Smith - Facilities Const. & Oprs.
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Pacific Southwest

Richard O'Connell - (Chairman)
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Irving M. Terrich
Louis W. Jefferson

Northeast

Lester Sutton - (Chairman), Facilities Const. & Oprs.
Edgar L. Bernard, Manpower Training
Hend Gorchev - Research and Development
Guy St. Andre - Facilities Const. & Oprs.
Kenneth Crotty, Public Affairs

PHOSPHORUS REMOVAL

Phosphorus is considered by many investigators to be the key nutrient in breaking the eutrophication cycle, however, conventional secondary plants are not efficient in phosphorus removal. Phosphorus enters a plant in the highest oxidized form. But, no common biological systems reduce phosphorus; therefore, it cannot be liberated in a gaseous form as nitrogen, carbon, and sulfur are.

If we are to reliably remove phosphorus from wastewaters on a sustained basis, we must choose chemical or chemical-biological methods. Strict chemical methods precipitate phosphorus either in the primary settler or in a tertiary clarifier. The chemical-biological method employs direct chemical dosing to the aerator of an activated sludge plant. The chemically-bound precipitated phosphorus is removed with the sludge and is not resolubilized during sludge disposal unless the pH is substantially lowered. Effluent phosphorus concentrations of 1-2 mg/l as P can be regularly achieved if the precipitation is accomplished in the primary or secondary portions of the plant. Tertiary lime clarification followed by filtration can lower the concentration to less than 0.5 mg/l.

Phosphorus can be removed by chemical treatment of raw sewage, mineral addition to the aerator in the activated sludge process, and tertiary clarification. Careful study of each design problem is required to determine treatment location and choice of chemicals. Iron coagulants, aluminum coagulants, and lime are commonly utilized. Iron coagulants are ferrous chloride, commercial or waste pickle liquor, and ferric chloride. Aluminum is added in the form of alum or sodium aluminate. Lime treatment involves use of single-stage or two-stage systems.

Factors affecting choice of chemicals are influent phosphorus level, effluent discharge standard, wastewater characteristics such as alkalinity, plant size, chemical costs including transportation, sludge handling facilities, ultimate sludge disposal alternatives, and other processes utilized.

Phosphorus can be removed from raw sewage by the addition of iron, lime, and polymers. Iron salts such as ferrous chloride are used at dosages from 1 to 2.5 mg of iron per mg of soluble phosphate. Chemical costs are about 1.5¢/1000 gal. Total costs are affected by the reduced load to secondary treatment units and will be determined from current studies.

R&D studies on phosphorus removal in the primary are listed below:

	Flow mgd	Chemical
Milwaukee, Wisconsin	110	Pickle Liquor
Grand Rapids, Mich.	45	Iron
Benton Harbor, Mich.	10	Iron
Mentor, Ohio	4	Pickle Liquor
Lake Odessa, Mich.	1	Iron
Grayling, Mich.	1	Iron
Texas City, Texas	1	Iron

By mineral addition to the aerator, phosphorus concentration in activated sludge process influent can be reduced from 10 to 2 mg/l or less by adding 1 to 2 parts of aluminum for each part of phosphorus. Chemical costs are about 3¢/1000 gal. for sodium aluminate. Costs including amortization of chemical feeders and maintenance are 4 to 5¢/1000 gal. Iron coagulants can also be utilized for some waste waters.

Tertiary clarification can be accomplished by use of lime or alum. Overflow rates for lime precipitation are about 1500 gpd/sf for single-stage and 1000 gpd/sf for 2-stage. Lime dosage is dependent on the alkalinity of the water, pH, and the degree of removal required. Single-stage treatment is practical for hard waters at dosages of about 300 mg/l. Soft waters generally require 2-stage treatment at dosages as high as 400 mg/l. Cost of lime at 300 mg/l is about 1.75¢/1000 gal. Economics of lime recalcination are dependent on disposal methods available.

Tertiary clarification with alum is accomplished with an aluminum to phosphorus ratio of about 2. If influent phosphorus concentration is 8 mg/l, alum cost is about 4¢/1000 gal. Overflow rate used is about 700 gpd/sf. Approximately twice the clarifier surface area is required as compared to lime. Sludge produced is voluminous and difficult to dewater. Recovery and reuse schemes are being currently investigated.

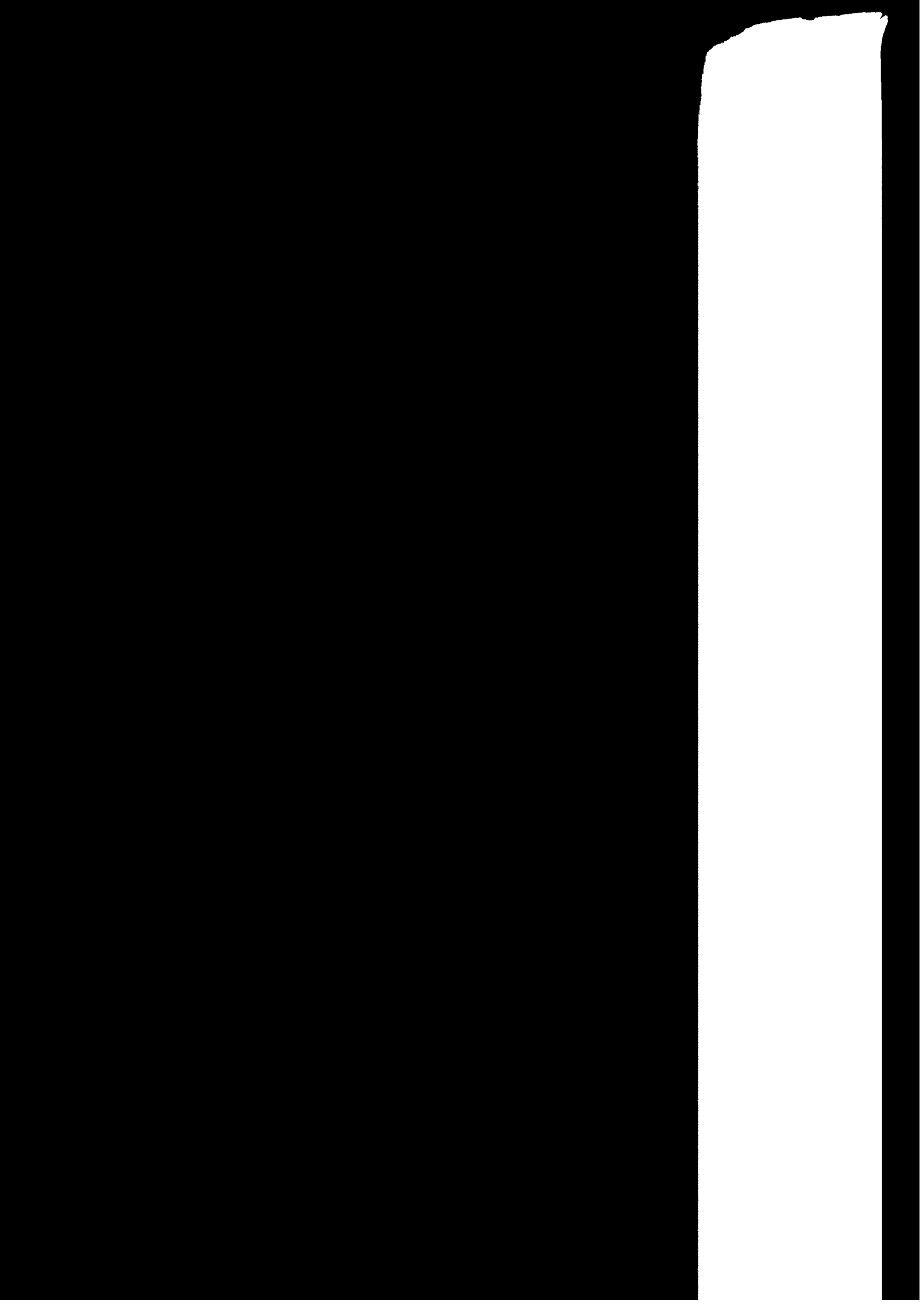
Technology for phosphorus removal is considered to be well developed and ready for widespread application. The following table is a partial list of full-scale plants now being designed and constructed.

PHOSPHORUS REMOVAL

PARTIAL LIST OF FULL-SCALE PLANTS

Treatment in Primary	Flow mgd	Chemical	Status
Detroit, Michigan	600	Iron	Design
Rochester, New York	100	Lime	Const.
Bay City, Michigan	12	Iron	Const.
Cky River, Ohio	10	Iron	Bids Taken
veland, Ohio	10	Iron	Design
so, Michigan	6	Lime	Design
Hsville, Ohio	5	Iron	Design
Hold Township, Pa.	5	Lime	Design
Wyc Michigan	4	Lime	Const.
Michigan	14	Iron	Design
Mineral			
on to Aerator			
Chicago			
Seattle, is	30	Iron	Design
Pomona, rton	20	Iron & Alum	Design
Xenia, Oh a*	2	Alum & Sod. Al.	Completed
Manassas,	1	Alum	Completed
Texas City,	1	Alum & Sod. Al.	Completed
	1	Iron & Alum	Completed
Treatment of Se			
luent			
South Lake Tahc			
Piscataway, Mary			
Colorado Springs,	7.5	Lime	On-Stream
Santee, Californi	5	Lime	Const.
El Lago, Texas	2	Lime	Const.
Lubbock, Texas	2	Iron & Alum	On-Stream
Hobbs, New Mexico	5		
Hatfield Township, P	5		
Piscataway, Maryland			

* Short term R&D studies



For additional information on the Technology Transfer Program or for additional details on the feature subject write:

Technology Transfer
Environmental Protection Agency
Water Quality Office
Washington, D. C. 20242

TECHNOLOGY TRANSFER

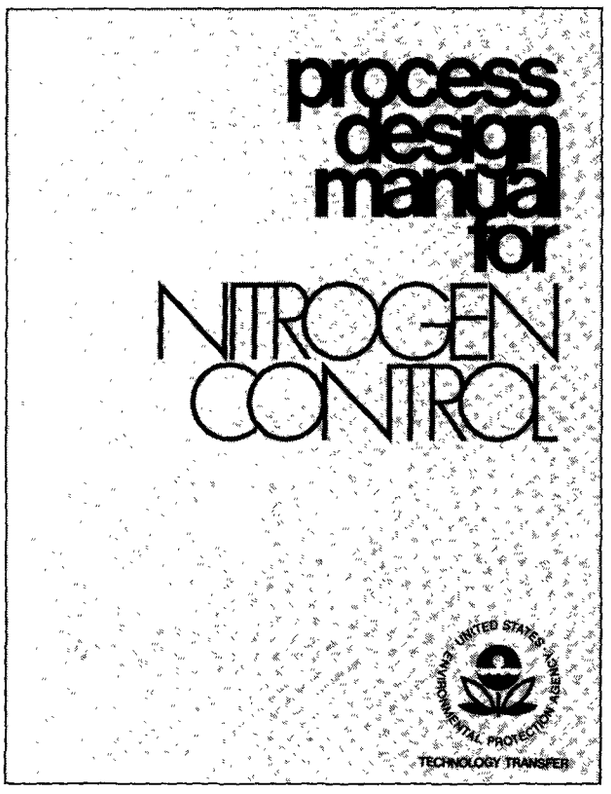
The Bridge Between Research and Use

U.S. ENVIRONMENTAL PROTECTION AGENCY — OCTOBER 1975

NEW TECHNOLOGY TRANSFER DESIGN MANUAL FOR NITROGEN CONTROL TO BE INTRODUCED AT WPCF CONFERENCE

EPA Technology Transfer will participate in the 48th Annual Conference of the Water Pollution Control Federation being held October 5-10, 1975 in Miami Beach, Florida. This will be the fifth consecutive year that Technology Transfer has participated in the WPCF Annual Conference with a major exhibit and new publication.

The new Technology Transfer Process Design Manual for Nitrogen Control will be introduced and distributed at the WPCF Miami Beach meeting. The new nitrogen manual, which will be the latest in the familiar blue binder series, covers all aspects of nitrification and nitrogen removal. The manual was prepared by Brown and Caldwell Consulting Engineers under the direction of Dr. Denny Parker with the physical-chemical sections by Gordon Culp of Culp, Wesner, and Culp. The manual manuscript was also extensively reviewed by Dr. Clair Sawyer and Dr. Perry McCarty as well as members of EPA's research and Technology Transfer staffs.



The manual is comprehensive in nature and includes the following major categories:

- Nitrogenous Materials in the Environment and the Need for Control in Wastewater Effluents
- Process Chemistry and Biochemistry of Nitrification and Denitrification
- Biological Nitrification
- Biological Denitrification
- Breakpoint Chlorination
- Selective In-Exchange for Ammonium Removal
- Air Stripping for Nitrogen Removal
- Total System Design

Host region for this year's conference will be EPA's Region IV. Jack E. Ravan, the Regional Administrator, will be present for the conference, as will Asa Foster, Chairman of the Region IV Technology Transfer Committee. It is expected that the WPCF Conference this year will draw a record attendance of the nation's top pollution experts.

SECOND NATIONAL CONFERENCE ON INDIVIDUAL ONSITE WASTEWATER SYSTEMS

Technology Transfer, in conjunction with the National Sanitation Foundation, is co-sponsoring the Second National Conference on Individual Onsite Wastewater Systems to be held November 5, 6, and 7, 1975 in Ann Arbor, Michigan.

Refer to inside last page of this publication for complete listing of current Technology Transfer publications.

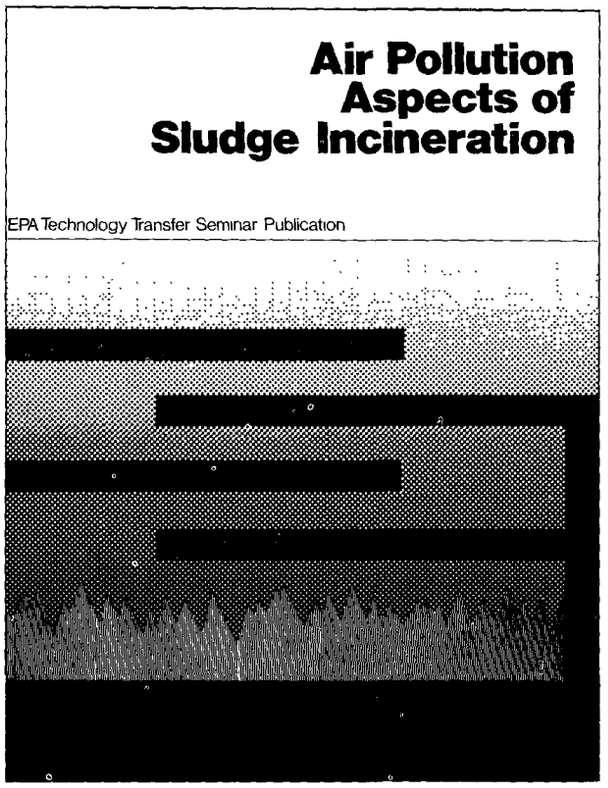
The purpose of this Conference is to present a comprehensive state-of-the-art review of the efficiency of individual onsite wastewater systems, and develop recommendations for related current and future research activities. Topics to be discussed include: Impact of Onsite Systems on Land Development; Newer Methods of Onsite Treatment and Disposal; Effects of Effluents on Groundwater; and Design Standards for Individual Onsite Wastewater Systems. The Keynote Address will be given by Mr. Joe G. Moore, Program Director, National Commission on Water Quality, Washington, D.C.

Additional information on this year's conference can be obtained from Dr. Nina McClelland, National Sanitation Foundation, P.O. Box 1468, Ann Arbor, Michigan 48106.

NEW MUNICIPAL SEMINAR PUBLICATION—"AIR POLLUTION ASPECTS OF SLUDGE INCINERATION"

A new Technology Transfer municipal seminar publication has been published and is now available for distribution. The publication, entitled "Air Pollution Aspects of Sludge Incineration," is partially extracted from the Technology Transfer Process Design Manual for Sludge Treatment and Disposal and additional case histories have been included. This publication discusses particulate matter, metals, gaseous pollutants, and organics and case histories on Livermore, Calif., and Palo Alto, Calif.

For your copy of this publication, use the order blank at the back of this newsletter.



TECHNOLOGY TRANSFER LAND TREATMENT SEMINAR SERIES

Four additional Technology Transfer design seminars on "Land Treatment of Municipal Wastewater Effluents" have been concluded in various areas of the country since May 1975. These were presented in Portland, Oregon, May 28-29; New York, N.Y., June 3-4; Denver, Colo., Sept. 4-5; and Kansas City, Mo., Sept. 9-10, 1975. Interest is continuing to be extremely high in this seminar series with attendance at the seminars varying from 250 to 350 engineers, state and federal regulatory personnel, and municipal engineers.

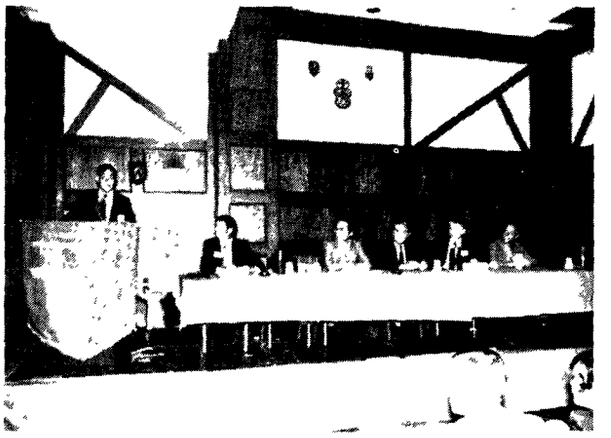
Key presentations have been given by Charles Pound, Metcalf & Eddy, Palo Alto, Calif.; Morgan Powell, CH_2M Hill, Denver, Colo.; Frank D'Itri, Michigan State University, Lansing, Michigan; Y. A. Demirjian, Muskegon County, Michigan; and Gordon Culp, Culp/Wesner/Culp, El Dorado Hills, California.

Future Seminars in the land treatment series are scheduled as follows:

Region	Location	Date
III	Philadelphia, Pa.	Oct. 23-24, 1975
V	Chicago, Ill.	Nov. 5-6, 1975
VI	Albuquerque, N.M.	Nov. 11-12, 1975
I	Boston, Mass.	Nov. 24-25, 1975

For additional details contact the appropriate Technology Transfer Regional Chairman, as listed in the back of this newsletter.

Dr. Beatrice Willard, Member of the Council on Environmental Quality in the Office of the President, addressing the Plenary Session at the Second National Conference on Complete WateReuse that was held May 4-8, 1975, in Chicago.



Various shots of participants and speakers at Land Treatment Seminars.

SEMINARS ON POLLUTION ABATEMENT IN THE FRUIT & VEGETABLE INDUSTRY

Technology Transfer, in association with the Food Processing Institute, will be conducting five Fruit & Vegetable Seminars this Fiscal Year. Present plans are to hold the first of the Seminars, scheduled for December, in Atlanta. This will be followed by Seminars in Portland, Oregon; Stockton, California; Chicago, Illinois; and Syracuse, New York, all to be held in the early spring.

The Seminar series will be directed towards plant engineers, managers and owners of fruit and vegetable processing facilities who have the responsibility of selecting pollution control systems.

Emphasis will be placed on information concerning proven control measures which are currently available to fruit and vegetable processors. The relative advantages, operating characteristics, and cost information on control methods will be presented where possible. The presentation will be supported with material on case studies when applicable.

Prior to the Treatment and In-Plant Technology Sessions, the latest environmental legislation will be discussed by the appropriate regulatory personnel. Following these technical sessions, an informative discussion on selecting the Optimum Financial Strategy for Pollution Control investment will be presented. This session has had a positive response in past seminars. A panel discussion, made up of program participants, will be held before adjourning.

(l-r) Walton Farr, Director, Dept. of Water, City of Dayton, Ohio; Dr. A. P. Black, Black, Crow and Eidsness; and Nicholas Lailas, Technology Transfer, at Technology Transfer exhibit at 95th AWWA Conference, Minneapolis, Minn., June 8-13, 1975.

LAND TREATMENT OF MUNICIPAL WASTEWATER EFFLUENTS

I. GENERAL

Land application of municipal wastewater effluents is now a viable alternative for municipal wastewater treatment. The Federal Water Pollution Control Act Amendments of 1972 requires that land treatment be given full and adequate consideration in the 201 Facilities Plans for all projects awarded after June 30, 1974.

The Technology Transfer Design Seminar Series was developed to provide federal, state, and municipal engineers and the consulting engineering profession with the latest design information and case histories to properly design information and case histories to properly design and evaluate land treatment as a treatment alternative.*

II. INTRODUCTION

Land application of municipal wastewaters or treated effluents entails the use of plants, soil surfaces and the soil martix for removal of certain wastewater constituents. Land application systems may be used not only for treatment, but also for a combination of water reuse and disposal, with the renovated water either discharged to the groundwater or collected for discharge to surface waters.

Table 1 is a representative list of the possible design considerations that may apply to most land application systems. A wide range of design possibilities exist due to specific site characteristics, climate, treatment requirements, and project objectives.

Because land application by nature must be site specific, and because a wide range of design possibilities is available, the designer must rely on a comprehensive understanding of the principles involved, site evaluation by specialists, and his own ingenuity. A multidisciplinary approach to planning land application systems is necessary, encompassing fields such as (1) environmental engineering, (2) hydrology, (3) soil science, (4) agriculture, (5) geology, and (6) land use planning.

*Portions of this article extracted from the Technology Transfer Design Seminar series on Land Treatment of Municipal Wastewater Effluents. Material from this series will be available through our order form within the next few months.

Table 1. General Design Considerations

Wastewater characteristics	Climate	Geology	Soils	Plant cover	Topography	Application
Flow volume	Precipitation	Groundwater	Type	Indigenous to region	Slope	Method
Constituent load	Evapotranspiration	Seasonal depth	Gradation	Nutrient removal capability	Aspect of slope	Type of equipment
	Temperature	Quality	Infiltration/ permeability	Toxicity levels	Erosion hazard	Application rate
	Growing season	Points of discharge	Type and quantity of clay	Moisture and shade tolerance	Crop and farm management	Types of drainage
	Occurrence and depth of frozen ground	Bedrock	Cation exchange capacity	Marketability		
	Storage requirements	Type	Phosphorus adsorption potential			
	Wind velocity and direction	Depth	Heavy metal adsorption potential			
		Permeability	pH			
			Organic matter			

III. METHODS OF LAND APPLICATION

The three basic methods of land application are irrigation, infiltration-percolation, and overland flow. Each method can produce renovated water of different quality, can be adapted to different site conditions and can satisfy different overall objectives.

A. Irrigation is the predominant land application method in use today. It involves the application of effluent to the land for treatment and for meeting the growth needs of plants. Treatment is accomplished by physical, chemical and biological means as the effluent seeps into the soil. Application is either by sprinkling or by surface techniques such as ridge and furrow or border strip flooding. Figure 1 schematically depicts the irrigation methods.

B. Infiltration-percolation is a method that applies the effluent to the soil at higher rates by spreading it in basins or by sprinkling. Treatment occurs as the water passes through the soil matrix. System objectives can include (1) groundwater recharge, (2) natural treatment followed by pumped withdrawal or underdrains for recovery, or (3) natural treatment with renovated water moving vertically and laterally in the soil and recharging a surface watercourse. Figure 2 schematically illustrates the infiltration-percolation method.

C. Overland flow is essentially a biological treatment process in which wastewater is applied

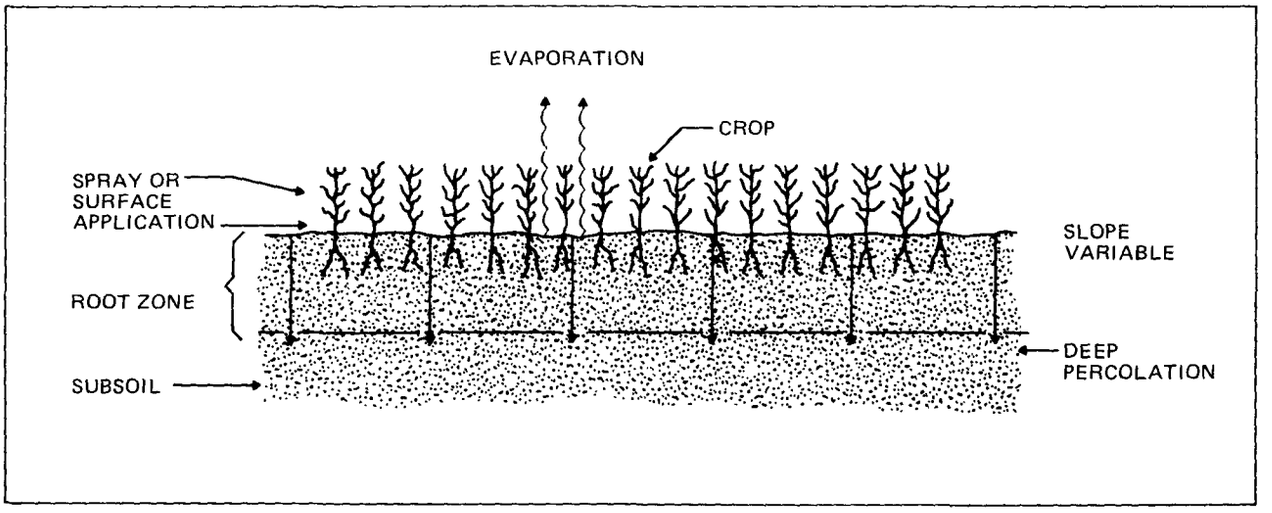


Figure 1.—Irrigation Method.

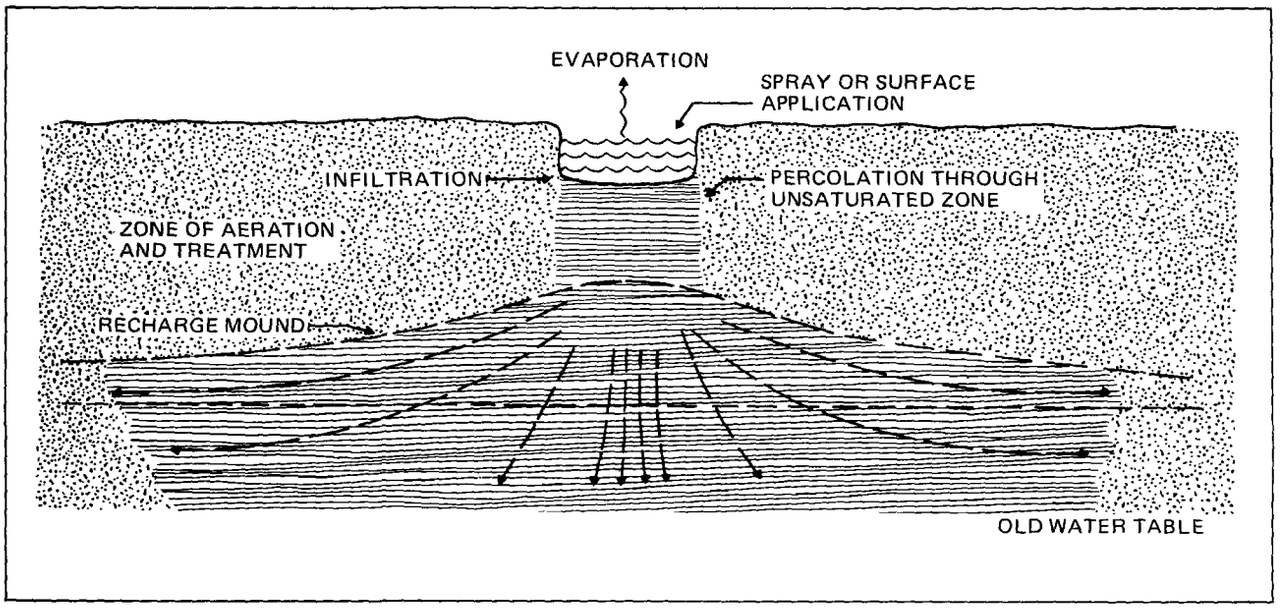


Figure 2.—Infiltration-Percolation Method.

over the upper reaches of sloped terraces and allowed to flow across the vegetated surface to runoff collection ditches. Renovation is accomplished by physical, chemical, and biological means as the wastewater flows in a thin sheet down the relatively impervious slope.

Overland flow can be used as a secondary treatment process where discharge of a nitrified effluent low in BOD is acceptable or as an advanced wastewater treatment process. The latter will allow higher rates of application (5 in./wk. or more), depending on the degree of advanced wastewater treatment required. Where a surface discharge is prohibited, runoff can be recycled or applied to the land in irrigation or infiltration-percolation systems. Figure 3 depicts the overland flow method.

IV. DESIGN FACTORS

A brief discussion of the essential design factors that must be considered to properly evaluate and design an effective and viable land treatment facility follows.

A. Preapplication Treatment – Treatment of wastewater prior to land application may be necessary for a variety of reasons, including (1) maintaining a reliable distribution system, (2) allowing storage or wastewater without nuisance conditions, (3) maintaining high infiltration rates into the soil, or allowing the irrigation of crops that will be used for human consumption.

B. Land Suitability – A checklist of characteristics to be evaluated for land suitability should contain the following general items: (1) location

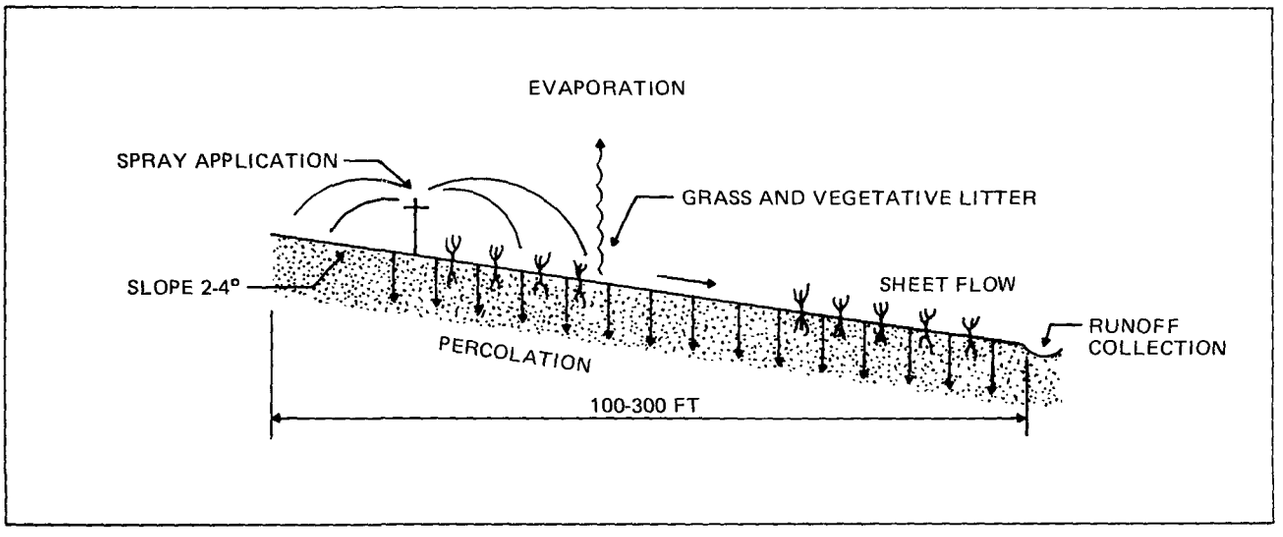


Figure 3.—Overland Flow Method.

with respect to point of wastewater collection/treatment facilities, (2) compatibility of planned objectives with overall land use plan, (3) proximity to surface waters, and (4) number and size of available land parcels.

C. Selection of the Land Application Method – Selection of the appropriate land application method requires matching the management of objectives and wastewater characteristics to the characteristics of potential sites, expected treatment efficiencies, and land requirements. Criteria for climate, topography, soil geology, hydrology, and vegetation vary with the type of land application method. Site evaluation is essential to the selection process.

D. Distribution Techniques – As many as 20 distribution techniques for water are available for engineered wastewater effluent applications. Many of the techniques developed in the irrigation industry have not yet been applied to wastewater. The most common techniques by application method follow.

1. Irrigation – Distribution techniques for irrigation can be classified into three main groups: fixed sprinkling systems, moving sprinkling systems, and surface application systems.

a. Fixed Sprinkling Systems, often called solid set systems, may be either on the ground surface or buried. Both types usually consist of impact sprinklers on risers that are spaced along lateral pipelines. These systems are adaptable to a wide variety of terrains and may be used for irrigation of either cultivated land or woodlands. Above-ground systems normally use portable aluminum pipe, which has the advantage of a relatively low capital cost. Several disadvantages of surface aluminum pipe are that: (1) it is easily damaged, (2) it has a short expected life due to corrosions, and (3) it must be moved during cultivation and harvesting operations.

Plastic or asbestos cement pipe is most often used for buried systems. Laterals may be buried as deep as 1.5 feet and amin pipelines, 2.5 to 3 feet below the surface. Buried systems generally have the greatest capital cost of any of the irrigation systems. On the other hand, they are probably the most dependable, and they are well suited to automatic control.

Sprinkler spacings, application rates, nozzle sizes and pressures, control systems, risers, and drain valves are the major design parameters in fixed sprinkling systems. General practice is as follows:

Sprinkler spacing – may vary from 40 to 60 feet to 100 by 100 feet and may be rectangular, square, or triangular. Typical spacings are 60 by 80 feet and 80 by 100 feet.

Application rate – may range from 0.10 to 1 in./hr or more with 0.16 to 0.25 in./hr being typical. Application rate is calculated using equation (1).

$$\text{Application rate, in./hr} = \frac{96.3Q \text{ (gpm per sprinkler)}}{\text{Area (sq ft covered)}} \quad (1)$$

Sample calculation: Determine the application rate for a spacing of 80 by 80 feet and a discharge per sprinkler head of 15 gpm.

$$\text{Application rate} = \frac{96.3\ (15)}{(80)\ (80)} = 0.23 \text{ in./hr}$$

Nozzles – Generally vary in size of opening from 0.25 inch to 1 inch. The discharge per nozzle can vary from 4 to 100 gpm, with a range from 8 to 25 gpm being typical. Discharge pressures can vary from 30 to 100 psi, with 50 to 60 psi being typical. Single-nozzle sprinklers are preferred because of lesser clogging tendencies and larger spray diameters.

Control systems – May be automatic, semiautomatic or manual. Automatic systems are the most popular for land application systems. Automatic valves may either hydraulically or electrically operated.

Risers – May be galvanized pipe or PVC of sufficient height to clear the crop, usually 3 to 4 feet for grass. The riser should be adequately staked because impact sprinklers cause vibrations that must be dampened.

Drain valves – Should be located at low points in line with gravel pits to allow water to drain away and prevent in-line freezing.

b. Moving sprinkling systems include (1) center pivots, (2) side roll wheel move, (3) rotating boom, and (4) winch-propelled sprinkling machines. The center pivot system is generally the most widely used for wastewater irrigation and is the only system discussed here. General practice with respect to sizes, propulsion, pressures, and topography is as follows:

Sizes – Center pivot systems consist of lateral that may be 600 to 1,400 feet long, which is suspended by wheel supports and rotates about a point. Areas of 35 to 135 acres can be irrigated per unit.

Propulsion – Either by means of hydraulic or electric drive. One rotation may take from 8 hours to as much as 1 week.

Pressures – Usually 50 to 60 psi at the nozzle which may require 80 to 90 psi at the pivot. Standard sprinkler nozzles or spray heads directed downward can be used.

Topography – Can be adapted to rolling terrain up to 15 to 20 percent.

c. Surface application systems can be grouped into ridge and furrow, and border strip flooding irrigation. Ridge and furrow irrigation is accomplished by gravity flow of effluent through furrows from which it seeps into the ground. General practice is as follows:

Topography – Can be used on relatively flat land (less than 1 percent) with furrows

running down the slope, or on moderately sloped land with furrows running along the contour.

Dimensions – Furrow lengths usually range from 600 to 1,400 feet. Furrows are usually spaced between 30 and 40 inches apart, depending on the crop.

Application – Usually by gated aluminum pipe. Short runs of pipe (80 to 100 feet) are preferred to minimize pipe diameter and headloss to provide maximum flexibility. Surface standpipes are used to provide 3 to 4 feet of head necessary for even distribution.

Border strip irrigation consists of low, paralled soil ridges constructed in the direction of slope. The major design variable for surface flooding using border strips include strip dimensions, method of distribution, and application rates. General practice is as follows:

Strip dimensions – Vary with type of crop, type of soil, and slope. Border widths may range from 20 to 100 feet; 40 to 60 foot widths are the most common. Slopes may range from 0.2 to 0.4 percent. The steeper slopes are required for relatively permeable souls. Strip length may vary from 600 to 1,400 feet.

Method of distribution – May generally be by means of either concrete-lined ditch with slide gates at the head of each strip, underground pipe with risers and alfalfa valves, or gated aluminum pipe.

Application rates – At the head of each strip, will vary primarily with soil type and may range from 10 to 20 gpm per foot width of strip for clay to 50 to 70 gpm per foot width of strip for sand. The period of application for each strip will vary with strip length and slope.

2. Infiltration-percolation – Intermittent flooding in basins is the most common distribution method, although high-rate spraying (more than 4 in./wk) may also be used. With flooding basins, the major design variables include application rate, basin size, height of dikes, and maintenance of basin surfaces.

3. Overland flow – Sprinkling is the most common technique in the United States; however, surface flooding may be practicable for effluents relatively low in suspended solids.

V. CLIMATIC FACTORS AND STORAGE

An evaluation of climatic factors, such as precipitation, evaportranspiration, and temperature, is important primarily for the determination of the (1) water balance, (2) length of the growing season, (3) number of days when the system cannot be operated, and (4) the storage capacity requirement. Another important function of climatic factors is stormwater runoff control.

A computer program, which relates many of these factors has recently become available through the National Climatic Center, in Asheville, North Carolina. It utilizes basic daily climatic data for a given weather station, for a given period of years, and identifies which days are unfavorable for application. The total storage capacity required each year can be calculated by adding one day's flow to storage each unfavorable day. Storage is then reduced

Table 2. Sample Printout of Climatic Data Program

Year	Month	Day	Temperature, deg F			Snow depth, in.	Precipitation, in.	Favorable day	Unfavorable day[a]	Storage, days
			Maximum	Minimum	Mean					
55	02	01	42	28	35	–	.01	X		
55	02	02	34	17	26	3	.45		X	1
55	02	03	33	7	20	2	–		X	2
55	02	04	19	6	13	2	–		X	3
55	02	05	31	11	21	2	–		X	4
55	02	06	46	30	38	T	.95		X	5
55	02	07	48	32	40	–	.05	X		4.5[b]
55	02	08	49	19	34	–	–	X		4
55	02	09	20	9	15	–	–		X	5
55	02	10	44	28	36	–	–	X		4.5

[a]Definition of unfavorable day:
Mean temperature ≤ 32 deg F
Precipitation ≥ 0.50 in.
Snow depth ≥ 1 in.

[b]Drawdown rate from storage on favorable days is 0.5 × daily flow; i.e., on favorable days the amount actually applied to the field is the average daily flow plus an extra 50% from storage.

by some fraction of a day's flow (based on the actual drawdown rate) for each favorable day. The maximum storage capacity is then identified for each year. A simplified sample printout for a portion of a month is shown in Table 2.

VI. SURFACE RUNOFF CONTROL

Requirements for control of surface runoff resulting from both applied effluent and stormwater depend mainly on the expected quality of the runoff—for which few data exist. Considerations relating to surface runoff control are mentioned here for both irrigation and overland flow systems. Infiltration-percolation are not included because in almost all cases these systems are designed so that no runoff is allowed.

A. Irrigation Systems – Surface runoff control considerations for systems can be divided into (1) trailwater return, (2) storm runoff, and (3) system protection.

B. Overland Flow Systems – Significantly, more extensive runoff control features are normally required for overland flow than for irrigation systems, because overland flow systems are designed principally for runoff of applied effluent rather than percolation. Typically, 40 to 80 percent of the applied effluent runs off. The remainder is lost to percolation and evapotranspiration. In most cases, the runoff is collected in ditches at the toe of each terrace and then conveyed by open channel or gravity pipe to a discharge point where it is monitored, and in some cases, disinfected. Discharge may be to surface waters, to reuse facilities, or sometimes to additional treatment facilities such as infiltration-percolation.

VII. PUBLIC HEALTH CONSIDERATIONS

Public health aspects are related to (1) the pathogenic bacteria and viruses present in municipal wastewater and their possible transmission to higher biological forms including man, (2) chemicals that may reach the groundwater and pose dangers to health if ingested, (3) crop quality when irrigated with wastewater effluents, and (4) the propagation of insects that could be vectors in disease transmission.

The survival of pathogenic bacteria and viruses in sprayed aerosol droplets, on and in the soil, and the effects on workers has received considerable attention. It is important to realize that any connection between pathogens applied to land with wastewater and the contraction of disease in animals or man would require a long and complex path of epidemiological events. Nevertheless, concern exists, and precautions should be taken in dealing with the possible transmission of pathogens.

VIII. MONITORING

As with any wastewater treatment facility, a comprehensive monitoring program will be required to ensure that environmental degradation is not occurring. Some monitoring requirements are similar to those required for conventional systems. One example of this is the monitoring of water quality at various stages in the process prior to application. Other monitoring requirements are generally unique to land application systems and these are the only ones mentioned here. They are presented in three categories:

A. Renovated Water – The monitoring of renovated water may be required for either groundwater or recovered water, or both. Recovered water may include runoff from overland flow or water from recovery wells or underdrains.

1. Groundwater – Water quality parameters that should be analyzed in the groundwater include (1) those normally required for drinking water supplies, (2) those that may be required for state or local agencies, or (3) those necessary for system control.

2. Recovered Water – Monitoring requirements for recovered water will depend on the disposition of that water. If the water is to be discharged, the parameters to be analyzed must include those required by NPDES permit. If the water is to be reused, analysis of additional parameters may be required by cognizant public health agencies. Monitoring of the flowrate of recovered water may be important for system control and may also be required as a result of water rights considerations.

B. Vegetation – When vegetation is grown as a part of the treatment system, monitoring may be required for the purpose of optimizing growth and yield. Conventional farm management techniques would generally apply; however, in many cases, special factors must be considered because of the normally higher hydraulic loading rates.

For some systems, a more detailed vegetation monitoring program may be required in which the uptake of certain elements is analyzed. This analysis would generally be required only in cases where potentially toxic constituents are present in the wastewater in abnormally high concentrations.

C. Soils – In almost all cases, the application of wastewater to the land will result in some changes in the characteristics of the soil. Consequently, some sort of soil monitoring program will be necessary for most systems with at least annual sampling recommended. Characteristics that commonly of interest include:

1. Salinity
2. Levels of various elements
3. pH
4. Cation exchange capacity

PROCESS DESIGN MANUAL FOR SULFIDE CONTROL IN SANITARY SEWERAGE SYSTEMS

The following changes should be made in the Process Design Manual for Sulfide control in Sanitary Sewerage Systems:

- Page 5-2: First equation should read as follows:

$$u_a = 3.0\sqrt{D}$$

- Page 5-4, first equation and page 5-8, both equations: The coefficient shown as 17×10^{-6} should be 17×10^{-5}. The answer to the problem, as shown on page 5-8, 16 cfm, is correct.

PROCESS DESIGN MANUAL FOR SUSPENDED SOLIDS REMOVAL (January 1975 Edition)

The following change should be made in the Process Design Manual for Suspended Solids Removal:

- Figure 10-9, page 10-15: Delete the "100" on the right-hand scale for Operation and Maintenance Costs. This number "10" should appear on the right-hand scale directly opposite the "1000" on the left-hand scale. Similarly, "100" should appear on the right-hand scale directly opposite the "10,000" on the left-hand scale.

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 your EPA Regional Technology Transfer Committee Chairman from the list below.

REGION	CHAIRMAN	ADDRESS
I	Lester Sutton	Environmental Protection Agency John F. Kennedy Federal Building Room 2304 Boston, Massachusetts 02203 617 223-2226 (Maine, N.H., Vt., Mass., R.I., Conn.)
II	Robert Olson	Environmental Protection Agency 26 Federal Plaza New York, New York 10017 212 264-1867 (N.Y., N.J., P.R., V.I.)
III	Albert Montague	Environmental Protection Agency 6th & Walnut Streets Philadelphia, Pennsylvania 19106 215 597-9856 (Pa., W. Va., Md., Del., D.C., Va.)
IV	Asa B. Foster, Jr.	Environmental Protection Agency Suite 300 1421 Peachtree Street, N.E. Atlanta, Georgia 30309 404 526-3454 (N.C., S.C., Ky., Tenn., Ga., Ala., Miss., Fla.)
V	Clifford Risley	Environmental Protection Agency 230 S. Dearborn St. Chicago, Illinois 60604 312 353-8880 (Mich., Wis., Minn., Ill., Ind., Ohio)
VI	Mildred Smith	Environmental Protection Agency 1600 Patterson Street, Suite 1100 Dallas, Texas 75201 214 749-1885 (Texas, Okla., Ark., La., N. Mex.)
VII	John Coakley	Environmental Protection Agency 1735 Baltimore Avenue Kansas City, Missouri 64108 816 374-5971 (Kansas, Nebr., Iowa, Mo.)
VIII	Elmer Chenault	Environmental Protection Agency 1860 Lincoln Street Denver, Colorado 80203 303 837-4343 (Colo., Mont., Wyo., Utah, N.D., S.D.)
IX	William Bishop	Environmental Protection Agency 100 California Street San Francisco, Calif. 94111 415 556-4806 (Calif., Ariz., Nev., Hawaii)
X	John Osborn	Environmental Protection Agency 1200 6th Avenue Seattle, Washington 98101 206 442-1296 (Wash., Ore., Idaho, Alaska)

For the following audio-visual material, please contact your Regional Technology Transfer Chairman. (See above)

MOTION PICTURES (16mm sound)

- Richardson Texas Project—Title: "Somebody around here must be doing something good." (15 min.)
- Phosphorus Removal (5 min.)
- Water Quality Management, Alameda Creek, Calif.—Title: "The Water Plan." (28½ min.)
- The Seattle METRO Story. (28 min.)

VIDEOTAPES

- Carbon Adsorption. (40 min.)
- Upgrading Activated Sludge Treatment Plants. (40 min.)

REQUEST FOR TECHNOLOGY TRANSFER MATERIAL

The publications listed on this form are the only ones available through the Office of Technology Transfer.

Please send me the following publications at no charge. (Check appropriate boxes)

PROCESS DESIGN MANUALS

- ☐ Phosphorus Removal 1001
- ☐ Carbon Adsorption 1002
- ☐ Suspended Solids Removal 1003
- ☐ Upgrading Existing Wastewater Treatment Plants 1004
- ☐ Sulfide Control in Sanitary Sewerage Systems 1005
- ☐ Sludge Treatment and Disposal 1006
- *☐ Nitrogen Control 1007

TECHNICAL CAPSULE REPORTS

- ☐ Recycling Zinc in Viscose Rayon Plants 2001
- ☐ Color Removal from Kraft Pulping Effluent by Lime Addition 2002
- ☐ Pollution Abatement in a Copper Wire Mill 2003
- ☐ First Interim Report on EPA Alkali SO_2 Scrubbing Test Facility 2004
- ☐ Dry Caustic Peeling of Peaches 2005
- ☐ Pollution Abatement in a Brewing Facility 2006
- ☐ SO_2 Scrubbing and Sulfuric Acid Production Via Magnesia Scrubbing 2007
- ☐ Second Interim Report on EPA Alkali Scrubbing Test Facility 2008
- ☐ Magnesium Carbonate Process for Water Treatment 2009

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

MUNICIPAL SEMINAR PUBLICATIONS

- ☐ Upgrading Lagoons 4001
- ☐ Physical-Chemical Treatment 4002
- ☐ Oxygen Activated Sludge 4003
- ☐ Nitrification/Denitrification 4004
- ☐ Upgrading Existing Wastewater Treatment Facilities—Case Histories 4005
- ☐ Flow Equalization 4006
- ☐ Wastewater Filtration 4007
- ☐ Physical-Chemical Nitrogen Removal 4008
- ☐ Air Pollution Aspects of Sludge Incineration 4009

BROCHURES

- ☐ Physical-Chemical Treatment 5001
- ☐ Phosphorus Removal 5002
- ☐ Upgrading Existing Wastewater Treatment Plants 5003
- ☐ Carbon Adsorption 5004
- ☐ Oxygen Aeration 5005
- ☐ Nitrogen Control 5006
- ☐ Seattle, Washington METRO 5007
- ☐ Wastewater Purification at Lake Tahoe 5008
- ☐ Indian Creek Reservoir 5009
- ☐ Richardson, Texas 5010

HANDBOOKS

- ☐ Analytical Quality Control in Water and Wastewater Laboratories 6001
- ☐ Monitoring Industrial Wastewater 6002
- ☐ Methods for Chemical Analysis of Water and Wastes 6003

*Publication listed for first time

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TECHNOLOGY TRANSFER

The Bridge Between Research and Use

U.S. ENVIRONMENTAL PROTECTION AGENCY — MAY 1975

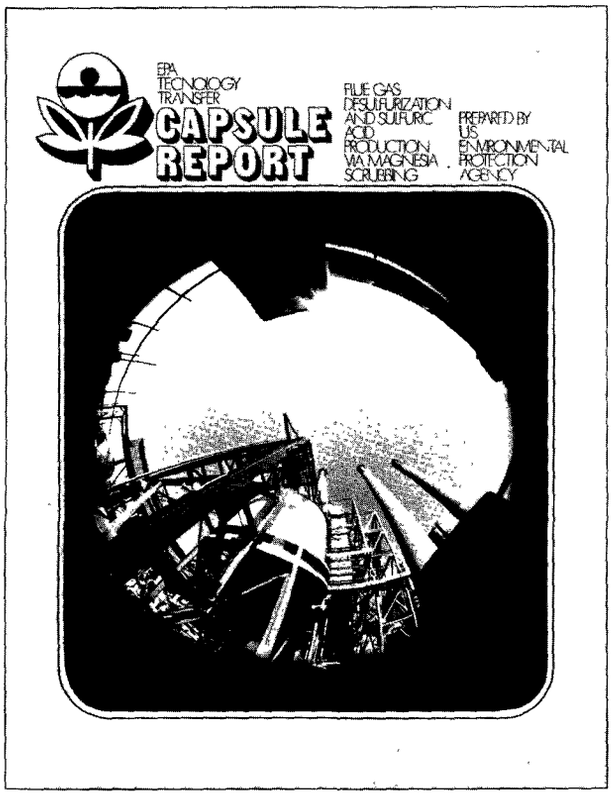
TECHNICAL CAPSULE REPORT ON FLUE GAS DESULFURIZATION AND SULFURIC ACID PRODUCTION VIA MAGNESIA SCRUBBING

A technical Capsule Report covering the two-year operation of a large prototype sulfur dioxide recovery plant based upon magnesia slurry scrubbing is presently being printed and will be available for distribution at the APCA '75 Exhibition, June 15-19, in Boston, Mass. This prototype program was jointly funded by EPA and Boston Edison Company. The SO_2 absorption plant was installed at Boston Edison's Mystic Station in Everett, Massachusetts, and the regeneration facility at Essex Chemical's Rumford, Rhode Island, sulfuric acid plant.

The Capsule Report describes both process operations at Boston Edison and Essex Chemical; the problems encountered during the test program, as well as the solutions to these problems; the economics of MgO scrubbing, MgO regeneration, and sulfuric acid production; and areas of application for this process.

During the operational period, the system demonstrated its ability to regenerate and reuse magnesium oxide. Over five thousand tons of commercial grade sulfuric acid were produced from magnesium sulfite and the scrubbing system demonstrated a consistent ability to achieve SO_2 removal efficiencies in excess of 90 percent using regenerated magnesium oxide. During the last four month period of the recovery system's operation, the monthly availabilities were 87%, 81%, 57% and 80%. The lowest reported value was due to the lack of MgO for SO_2 removal, caused by problems in the sulfuric acid plant and an intentional emptying of the MgO silos during a controlled test.

For your copy of this Capsule Report, use the order blank at the back of this newsletter.



TECHNOLOGY TRANSFER LAND TREATMENT SEMINAR SERIES

Technology Transfer recently completed the first two of a series of design seminars on "Land Treatment of Municipal Wastewater Effluents". The first two seminars were held in **Atlanta, Georgia**—April 23-24, and **San Francisco, California**—May 7-8, 1975. This seminar series is aimed at providing federal, state and municipal engineers and the consulting engineering profession with the latest design information to properly design and evaluate land treatment as a viable treatment alternative.

Russell E. Train, USEPA Administrator, initiated the seminar series and presented the introduction and purpose to the 330 plus attendees at the Atlanta Seminar.

Interest has been extremely high at both seminars due to the timeliness of this subject area. The latest design factors and cost compari-

Refer to inside last page of this publication for complete listing of current Technology Transfer publications.

sons are covered in detail. Case histories are presented on successful projects and the up-to-date status of the Muskegon, Michigan, EPA demonstration project is discussed. Seminars for the other EPA Regions are being planned and detailed information may be obtained from contacting the respective Regional Technology Transfer Chairmen. Following is a general outline of the seminar format:

- **EPA's APPROACH TO LAND TREATMENT AND COST EFFECTIVENESS**
- **DESIGN FACTORS**
  - Introduction & Pretreatment
  - Overland Flow
  - Irrigation (Nutrient/Water Utilization)
  - Infiltration-Percolation
  - Site Selection
  - Storage (Total Water Balance)
  - Land Availability
  - Distribution Techniques
  - Public Health Considerations
  - Monitoring (Need)
  - Land Use
  - Climate, Topography
  - Surface Runoff Control
  - Hydraulic Loading
  - Nutrient Loading
  - Soil
  - Water Rights
  - Crop Selection (Forest Application-Hardwood/Softwood)
  - Heavy Metals
  - Farming Management
  - Underdrain Systems
  - Groundwater Conditions
  - Monitoring (Location)
- **REVIEW OF SIGNIFICANT LAND TREATMENT PROJECTS**
  - Overview & EPA-APWA Report
- **MISC. CASE HISTORIES**
  - Penn State
  - Mich. State
  - Melbourne
  - Phoenix
  - Tallahassee
- **MUSKEGON, MICHIGAN, PROJECT**
- **COST OF LAND APPLICATION SYSTEMS**
- **EXAMPLE COMPARISON OF LAND TREATMENT AND AWT**

Presentations at the seminars have been given by Bill Whittington, Office of Water Program Operations (OWPO), EPA, Washington, D.C.; Charles Pound, Metcalf & Eddy, Palo Alto, Calif.; Morgan Powell, CH_2M/Hill, Denver, Colo; Belford Seabrook, OWPO, EPA, Washington, D.C.; Frank D'Itri, Michigan State University, Lansing, Michigan; Y. A. Demirjian, Deputy Director of Public Works, Muskegon County, Michigan; and Gordon Culp, Clean Water Consultants, Eldorado Hills, Calif.

95TH AWWA CONFERENCE

Technology Transfer will provide a manned exhibit for the 95th Annual American Water Works Association Conference in **Minneapolis, Minnesota,** June 8-13, 1975. Over five thousand private and municipal water utility personnel are expected to attend the meeting, which is being held at the Minneapolis Convention Hall.

The theme of the exhibit will be a Technical Capsule Report on "Magnesium Carbonate—A Recycled Coagulant for Water Treatment", which will be initially distributed at the Conference.

MONITORING SEMINARS

Technology Transfer held six more Monitoring Industrial Wastewater seminars for industry. Each of these seminars was well attended by plant managers and engineers. Dates and locations of the Monitoring seminars were:

January 9, 1975	**Washington, D.C.**
February 18, 1975	**Kansas City, Missouri**
February 19, 1975	**Denver, Colorado**
March 11, 1975	**Oklahoma City, Oklahoma**
March 13, 1975	**Houston, Texas**
March 20, 1975	**Chicago, Illinois**

Mr. John Quarles, Deputy Administrator of EPA gave the welcome address at the Washington seminar. Mr. Quarles emphasized the development of a practical approach to monitoring as it relates to permit conditions. He also stressed the need for a cooperative effort by the Federal Government, the states, and the discharger to meet their respective monitoring responsibilities under PL 92-500.

The morning session of these seminars covered EPA regulatory policy with regard to the monitoring requirements of PL 92-500. States within respective EPA regional offices presented their relationships to the Federal Program with regard to monitoring policies and requirements.

Mr. John Quarles, EPA Deputy Administrator, at the Washington, D.C. Monitoring Seminar.

The afternoon sessions offered technical guidance for implementing a monitoring program. Gerry Shell of AWARE, Inc. concentrated on an overview of Monitoring Industrial Wastewater. Dr. Phillip Shelley of Hydrospace-Challenger discussed Sampling. The session on Flow Measurement was presented by Vic Jelen of the EPA Cincinnati Field Investigation Center. The session on Analytical Quality Control was prepared by Robert Booth of the EPA Cincinnati Methods Development and Quality Assurance Research Laboratory. The final session on In-Process Monitoring was presented by Walter Zabban of Chester Engineers.

MUNICIPAL DESIGN SEMINARS

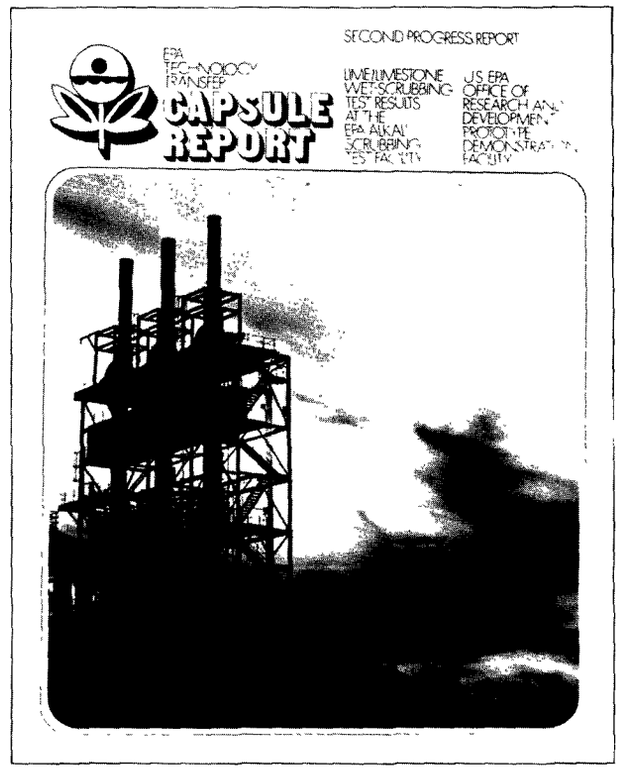
One additional Technology Transfer municipal design seminar has been conducted since the January, 1975, newsletter was published. A special cold climate treatment seminar was held in **Anchorage, Alaska** on April 9-10, 1975.

The Anchorage Seminar included technical sessions on cold climate biological treatment and physical-chemical treatment. Ernst Mueller, Commissioner of the Department of Environmental Conservation for the State of Alaska, opened the seminar attended by approximately 135 consultants and regulatory personnel. Technical presentations during the two-day seminar were given by Lee Reid, Borough of Anchorage; Jack Grainge, Environmental Protection Service, Environment Canada; Gene Suhr, CH_2M/Hill; Jack Cleasby, Iowa State University; Gordon Culp, Clean Water Consultants; Joe Rizzo, Calgon Corporation; and Randy Bayliss, State of Alaska. EPA speakers were Jack Coutts and Jim Westrick.

TECHNICAL CAPSULE REPORT ON LIME/LIMESTONE WET-SCRUBBING

A technical Capsule Report covering progress at the EPA alkali test facility at the TVA Shawnee Power Station is presently being printed and will be available for distribution at the APCA '75 Exhibition, June 15-19, in **Boston, Massachusetts.** The Capsule Report is the 2nd in a series on the Shawnee project, with each new capsule report being prepared when significant test data have been developed.

The Shawnee test facility consists of three parallel scrubber systems: (1) a venturi followed by a spray tower; (2) a Turbulent Contact Absorber (TCA); and (3) a Marble-Bed Absorber. Each system is capable of treating approximately 10 Mw equivalent (30,000 acfm



@ 300° F) of flue gas containing 1800-4000 ppm sulfur dioxide and 2 to 5 grains/scf of particulates.

The limestone and lime reliability testing at the Shawnee facility has shown that scrubber internals can be kept relatively free of scale if the sulfate (gypsum) saturation of the scrubber slurry is kept below about 135 percent.

For your copy of this Capsule Report, use the order blank at the back of this newsletter.

TECHNICAL CAPSULE REPORT ON MAGNESIUM CARBONATE– A RECYCLED COAGULANT FOR WATER TREATMENT

A technical Capsule Report describing a new magnesium recycle coagulation system for water treatment is presently being printed, and will be available for distribution at the 95th Annual Conference of the American Water Works Association (AWWA) in **Minneapolis, Minnesota,** June 8-13. The system is based on a combination of water softening and conventional coagulation techniques which can be applied to all types of water.

The process development began in 1957 at the Dayton, Ohio, water treatment plant where a hard, clear, high magnesium water is softened by a lime-soda process. The cities of Melbourne, Florida, and Montgomery, Alabama, have also provided additional support to the development of the magnesium carbonate coagulation system.

Approximately 1 million tons per year of dry solids are produced from an estimated 3,600 water treatment plants practicing coagulation throughout the country. Of these, less than 5 percent receive treatment of any kind before return to the water course. Wastes from water treatment plants are today recognized as a significant pollution problem. The new process offers an alternative approach to chemical sludge handling as well as providing for reuse of the chemicals.

For your copy of this Capsule Report, use the order blank at the back of this newsletter.

PROCESS DESIGN MANUAL FOR SLUDGE TREATMENT & DISPOSAL

The following changes should be made in the Process Design Manual for Sludge Treatment and Disposal:

- Figure 8-4, page 8-9: BTU rating should read–1,000 BTU/CF
- Figure 9-2, page 9-11: Curves were based on a sludge concentration after thickening to 3-1/2% solids.

TECHNOLOGY TRANSFER/AICHE CO-SPONSOR THE 2ND NATIONAL CONFERENCE ON COMPLETE WATER REUSE (WATER'S INTERFACE WITH ENERGY, AIR AND SOLIDS)

Technology Transfer and the American Institute of Chemical Engineers jointly sponsored the 2nd National Conference on Complete Water Reuse, held at the Palmer House, May 4-8, 1975, in **Chicago, Illinois.**

The Conference brought together government, industry, management, and environmental personnel to consider and evaluate the meaning and potential for complete water reuse systems to fulfill the objective of Public Law 92-500 for Zero Discharge of Pollutants, and Water's Interface with Energy, Air and Solids.

Session topics included: Land Disposal of Wastewaters and Sludges; Technology Transfer in Water Reuse; Energy; and Air/Water Interface.

APCA '75 MEETING AND EXHIBITION

Technology Transfer will exhibit recent air-related publications at the 68th Annual Air Pollution Control Association Meeting and Exhibition, to be held June 15-19, 1975, in **Boston, Massachusetts.** Technical sessions will be conducted at the Sheraton Boston, which is directly connected to the John B. Hynes Civic Auditorium exhibit hall.

The Conference will bring together government, industry, management, air pollution equipment manufacturers, and environmental personnel to learn about the latest technical developments in air pollution effects, measurement and control.

Participants at Technology Transfer Textile Seminar held in Boston on January 15-16, 1975. In front row (l-r) Mr. Luis Dichtl Subias of Empresa National Adaro, Spain; Mr. Fernando Troyano Lobaton of Spain's Ministry of Public Works; and Mr. Jaime Ruiz Rodriguez of Spain's Ministry of Industry.

EPA's OFFICE OF ENERGY RESEARCH

The Office of Energy Research (OER) of EPA's Office of Research and Development is a new office operating within a highly dynamic environment. Not only is the OER responsible for the design, planning and strategic management of a $130-million FY 75 research and development program, but it is doing so within an interagency context which is quite unique.

Dr. Stephen J. Gage, Acting Director of OER and formerly of CEQ, and his staff of eight professionals have designed a R&D program based upon two major interagency working group reports. These reports—**Health and Ecological Effects of Energy Use** and **Environmental Control Technology for Energy Systems**—embody the recommendations of more than a dozen federal agencies, offices and laboratories. In developing these recommendations into a balanced energy/environment R&D program, the OER has had to work in close coordination with the EPA research centers and laboratories for the portion of the work to be performed by EPA, and with other federal agencies for those projects which they will be implementing.

In order to assure the success of this massive and complex planning exercise, the OER evolved an entirely new and highly simplified planning system. The guiding philosophy behind this new planning system is that the proper role for OER in headquarters is one of strategic planning, information integration and transfer, and program and resource balancing. This more limited role requires the delegation of the responsibility for detailed program implementation and management to the field and to those management individuals closest to the research efforts. Implementation of this philosophy required a new set of operating procedures.

The first step in the implementation of the energy/environment R&D program involved the identification of key outputs necessary for an effective program. These outputs range from "initiate demonstration of regenerable sulfur-producing flue-gas desulfurization system" to "produce users manual on cold climate shoreline protection and restoration". They all have two things in common, however. First, they are discrete, identifiable, tangible units, and second, they are all essential parts of a balanced energy/environment R&D program.

Once these necessary outputs have been identified, short descriptions are sent to the appropriate EPA operation or other agency. This other organization reviews the output description and, within the time and resources allotted, provides OER with an accomplishment plan designed to provide the necessary outputs. This process yields several benefits. First, it assures that both OER and field research manager understand what is required. Second, it involves a high level of interaction among all parties involved in a particular research area, thus establishing linkages for future research coordination and information transfer. Third, it reduces to an absolute minimum the amount of paperwork involved.

The program itself is being planned on a five year basis with approximately $130 million programmed for expenditures in FY 75. The purpose of the program is the development of a sound scientific and technical basis for ensuring (1) adequate protection of human health, welfare, ecosystem and social goals; (2) environmental protection necessary to facilitate the use of energy supplies, with particular emphasis on domestic fuels; (3) implementation of energy system initiatives without delays caused by inadequate and insufficient environmental impact data; (4) development of appropriate cost-effective control technologies for emerging energy systems; and (5) assessment of environmental implications of energy conservation measures in order to maximize the energy savings and minimize the associated impacts.

The EPA energy-related environmental research and development program is divided functionally into three activities: (1) the Processes and Effects program to determine the environmental effects (and hence the control requirements) associated with energy extraction, transmission, conversion and use, (2) the Environmental Control Technology Program to identify, develop and demonstrate necessary control techniques based on the source effluent and ambient pollutant control requirements specified in (1), and (3) the Policy Implementation Research Program to evaluate the environmental, economic and social consequences of alternative control strategies for energy systems as input to EPA policy formulation. Each of these three programs is addressed in more detail below.

The energy-related processes and effects research program is composed of three general subactivities: pollutant identification, measurement and monitoring; health effects; and freshwater, marine and atmospheric/terrestrial ecological processes and effects. The program is designed to determine the environmental effects associated with energy extraction, transmission, conversion and use so that measures can be taken in a timely manner to protect human health, the ecosystem and social goals. Identification of the pollutants released by energy-related industrial operations and determination

of their impact on the human and natural environment will define the environmental control requirements for the pollution operations.

The environmental control technology program is divided into four general subactivities: extraction and beneficiation, fossil fuel combustion, synthetic fuels, and advanced systems and conservation. The program is designed to identify, develop and demonstrate cost-effective control techniques for energy extraction, transmission, conversion and use. The program necessarily involves assessment of the pollution potential of source effluent streams and the technological processes producing those pollutants as well as research and development on control devices and process modifications to reduce the impacts of the pollutants on ambient conditions. The thrust of the program is to provide adequate environmental protection as the Nation moves toward expanding use of domestic fuels.

The policy and implementation research program objective is to provide the information necessary to develop comprehensive environmental protection standards for energy production activities while attempting to balance the environmental and economic costs. The comprehensive evaluation of environmental, economic and social consequences of energy alternatives is intended for use as a basis for EPA policy formulation.

EPA's CONTROL SYSTEMS LABORATORY

As a part of EPA's Office of Research and Development, the Control Systems Laboratory (CSL), based in Research Triangle Park, North Carolina, has unique, wide-ranging responsibility in stationary source air pollution control and energy-related programs. CSL, under its director, Dr. John K. Burchard, is currently funding approximately 300 projects encompassing a broad range of research, development and demonstration programs interrelated by a common objective. The work of CSL is geared to answer the challenge of Section 101.(b)(2) of the Clean Air Act "to initiate and accelerate a national research and development program to achieve the prevention and control of air pollution." Over the last decade, CSL has established a comprehensive program to determine air pollution sources, assess the environmental impact of identified pollutants, and accelerate the development and commercial application of air pollution control processes.

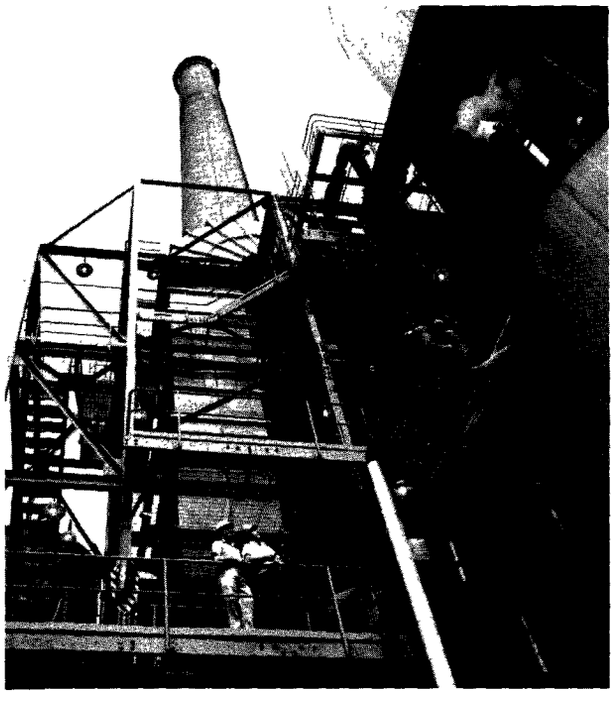
Many of the technologies which show promise as solutions to environment/energy problems originated in CSL. In such diverse areas as flue gas cleaning, clean fuels, combustion modification, pollution control for metallurgical and chemical processes, and particle cleanup, Control Systems Laboratory has taken the developmental initiative through co-sponsorship of major research, development, and demonstration (RD&D) projects, contractual studies, and in-house efforts.

Subdivided programmatically, CSL consists of four Branches: Gas Cleaning and Metallurgical Processes, Clean Fuels and Energy, Particulate and Chemical Processes, and Engineering Analysis. The Engineering Analysis Branch provides the staff function of program monitoring and evaluation support, including project evaluations, program reviews, and industrial processes catalog development.

The three line branches are engaged in a wide spectrum of control systems development work, ranging from small-scale experimental research to full-scale prototype demonstration and evaluation.

The Gas Cleaning and Metallurgical Processes Branch is developing and demonstrating flue gas cleaning for fossil fuel-fired electric utility power plants and industrial boilers, and pollution control systems for metallurgical processes such as in the iron and steel, and smelting industries.

Environmental assessment, pollution control for fuel conversion systems, development of



Research Project—Magnesia Slurry Scrubbing System for SO_2 Removal at Boston Edison.

combustion modification techniques for nitrogen oxides control, and physical and chemical fuel cleaning are the responsibilities of the Clean Fuels and Energy Branch.

The Particulate and Chemical Processes Branch is concerned with control of pollutants from chemical processes, development and demonstration of fine particulate control, improvement of conventional particulate control equipment, and evaluation and development of measurement, sampling, and analysis techniques and equipment.

• FLUE GAS DESULFURIZATION

To date, about 80 percent of CSL's total expenditures have been related to control of sulfur oxides (SO_x) emissions from fuel combustion and have been concentrated in flue gas desulfurization (FGD). The efforts of CSL have accelerated the development of FGD so that it is now in the process of commercialization in this country. Over 100 flue gas desulfurization systems are currently in operation, under construction, or planned.

CSL has been deeply involved in development/demonstration of the following flue gas desulfurization processes. (See table at bottom of this page.)

An advanced FGD process producing elemental sulfur as the major system by-product and a double alkali FGD system are new full-scale development/demonstration projects currently being planned.

In addition CSL has projects underway to improve FGD performance and reliability, and to evaluate and broaden the scope of FGD applications. These projects include determining chemical and physical properties of throwaway sludge, development/demonstration of environmentally acceptable disposal technology, the evaluation of technologies and markets for sludge utilization, purge reduction/elimination studies, evaluation of reductant gas technologies for by-product sulfur production, studies in overall FGD economics and applicability of FGD to non-utility combustion sources, and studies on the marketability of abatement sulfur and sulfuric acid from utility power plants.

• CLEAN FUELS

A second alternative to control SO_x emissions is to remove the sulfur from fuel prior to combustion. CSL has developed and improved methods to physically clean coal of sulfur and ash, thus reducing the fuel's potential to pollute. This program is continuing, with emphasis placed on improving available means of coal cleaning, and evaluating and sponsoring novel techniques of physical pollutant removal. The 2-stage froth-flotation technique for separating pyrite from very fine coal will be demonstrated. A coal cleaning manual is being prepared which will aid in implementation of this technology. Methods are also being developed with CSL's assistance to chemically clean sulfur from coal. This project has been demonstrated successfully at the laboratory scale and a pilot scale operation is currently under negotiation. Other methods of pre-combustion cleaning of fuels are being investigated to determine their potential for control of sulfur, nitrogen, hazardous elements and compounds, and particulates. One of these methods removes vanadium and nickel from high metals, high sulfur residual oils, yielding a low polluting fuel oil.

Process	Waste/By-Product	Application	SO_2 Removal Efficiency
Wet Lime/Limestone Scrubbing	Throwaway Sludge	30 Mw (prototype) coal-fired utility	75-90%
Wet Lime Scrubbing	Throwaway Sludge	40 Mw (full-scale) oil-fired utility	60-80%
Magnesium Oxide Scrubbing	98% Sulfuric Acid	155 Mw (full-scale) oil-fired utility	85-90%
Magnesium Oxide Scrubbing	98% Sulfuric Acid	100 Mw (full-scale) coal-fired utility	85-90%
Catalytic Oxidation	98% Sulfuric Acid	100 Mw (full-scale) coal-fired utility	85-90%
Wellman-Lord/Allied	>99% Elemental Sulfur	115 Mw (full-scale) coal-fired utility	90-95%
Double Alkali	Throwaway Sludge	30 Mw (full-scale) coal-fired industrial	85-95%

Pollutant levels in dirty fuels (coal and oil) can be decreased by fuel conversion processes such as gasification or liquefaction. These processes remove potential pollutants from the raw fuel to provide clean synthetic fuels. In order to ensure that these systems do not simply transfer the environmental problems from the fuel usage to fuel processing, a significant effort is underway to environmentally assess the entire systems. The assessment is resulting in the identification of more environmentally sound and economic systems and is supplying input to environmental control technology development. The converted fuels could be utilized in many ways. One promising method uses the fuel in combined cycle power generation. CSL has performed studies in the past and is currently performing studies on the best integrated combined cycle approach for achieving both environmentally sound and economic total systems. In conjunction with this study, CSL is co-sponsoring the development of a high temperature fuel gas desulfurization system which could be utilized as one step of the total system.

There is a potential for developing nonpolluting fuels from wastes. A full-scale system which utilizes municipal waste as a fuel source is being demonstrated under CSL leadership. As with other fuel usage systems, an important aspect is to ensure that the system is environmentally sound.

• COMBUSTION MODIFICATION

Absorption of sulfur during combustion is another approach being studied by CSL to reduce sulfur oxides emissions. Since 1967, this Laboratory has been actively developing fluidized-bed combustion for coal, and fluidized-bed gasification/desulfurization of residual oil as a means of economical pollution control in steam and power generation. Study of the environmental control potential of the fluidized-bed coal combustion process has advanced to the stage where a 630 kW (equivalent) pilot plant, capable of being operated at up to 10 atm pressure, has been built. Bench scale testing of the fluidized-bed coal combustion process has demonstrated 90-95 percent SO_2 removal at low sorbent addition rates, and up to 80 percent reduction of NO_x emissions. Cost estimates indicate a potential power cost savings for new fluidized-bed boiler plants of 10-15 percent compared to new conventional pulverized-coal boilers with flue gas desulfurization. The environmental potential of the Chemically Active Fluid Bed process for gasifying and desulfurizing heavy fuel oil has been demonstrated in a CSL co-sponsored pilot-scale program. The pilot testing of the process has accomplished impressive reduction of sulfur, vanadium, nickel, sodium, and nitrogen oxides emissions. Economic studies indicate that the process appears to have viable commercial potential. The design of a larger, demonstration scale project is now underway.

Combustion modification techniques are being developed as control methods for nitrogen oxides and other pollutants from existing and new conventional stationary combustion sources, and recent studies indicate that this technological approach is the primary near-term method of controlling NO_x emissions from the combustion of fossil fuels. CSL supported and directed efforts have shown that promising combustion modification techniques include combustion with low excess air, staged combustion, recirculation of flue gas in the fuel/air mixture, and burner/combustor systems redesign. The major emphasis to date has been on combustion control for the electric utility industry since this industry ranks first among the stationary sources as a contributor of NO_x emissions and a major user of fossil fuels. Industrial, commercial and residential combustion sources have also been subjects for significant R&D because of their fuel usage and the potential impact of area source emissions.

Field testing of state-of-the-art combustion modification for residential and commercial heating systems, industrial boilers, and utility boilers is well advanced, and the results are the basis for design and user manuals to inform and guide manufacturers and operators in the application of the technology. Pilot demonstrations of staged combustion and other techniques for coal-fired utility boilers (firing both Eastern and Western coals) at field sites are underway. Reports of these investigations will provide practical operating information on the effects of the control techniques on NO_x and other emissions and on unit performance. Similar studies are planned and are being initiated for other major combustion source categories in an effort to provide maximum stationary source technology for NO_x control.

• POLLUTION CONTROL FOR METALLURGICAL AND CHEMICAL PROCESSES

Control Systems Laboratory is also developing, evaluating, and improving air pollution control systems for metallurgical industries. Because of the different nature of each industry and different technical and economic constraints confronting it, programs to develop air pollution control technology have been tailored to each industry. The most significant advances to date have been in the control of emissions from coking operations. A full-scale demonstration by CSL in the development of coke oven charging control methods has led to the commercial installation of smokeless coke charging systems

by several coke producers. Other promising demonstration programs in coke pushing and quenching are nearing completion. Novel coke oven door sealing techniques are now being evaluated and will be tested on operating ovens in the next fiscal year.

Another metallurgical process for which CSL is developing control techniques is the charging of basic oxygen furnaces. This development program, being conducted on a 1 ton pilot furnace, is concentrated on process modifications, including development of a prototype emission collection system and a gas cleaning system that will allow emissions to be collected.

Recirculation of sinter plant effluent gases is being studied as a means to control the large quantities of particles, hydrocarbons, and other gaseous emissions which are currently being emitted from these plants. CSL co-sponsorship has assisted in the development of a windbox gas recirculation system which is being installed on a commercial sinter plant. This process appears to be a viable solution to the sinter plant emission problem, with initial results indicating significant reduction of both plant emissions and system energy requirements.

Evaluation and/or developmental control process work is also being conducted for the iron foundry cupola, secondary aluminum smelters, ferro-alloy furnaces, and primary copper, lead, and zinc smelters.

The control of emissions from chemical and petroleum processes is also being studied by CSL. Steam stripping for the control of sulfur oxides from petroleum catalytic cracker regenerators has been tested favorably in a laboratory program. Available alternatives to control sulfur emissions from refineries and determination of the economic impact of various levels of control on the petroleum industry are currently being studied. Efforts to control atmospheric emissions from nitric and sulfuric acid plants are presently concentrated on treatment of tailgases from these industries. Demonstration programs are currently underway to evaluate the efficiency of a promising process for cleanup of these gases. Control of hydrocarbons is being tested for solvent evaporation operations, ethylene dichloride manufacture, and other stationary sources.

• PARTICLE CONTROL

Much progress has been made in recent years to control particulate matter emissions. Systems currently used for particulate removal (i.e., scrubbers, electrostatic precipitators, and fabric filter particle collectors) are receiving continued development and improvement through research conducted by Control Systems Laboratory. This CSL program has led to the development of a new class of scrubber systems. Called the Flux Force/Condensation scrubber, this system is currently being tested at the pilot scale demonstration stage. The control of fine particulate (less than 3 microns) is receiving high priority because these particles persist in the atmosphere, comprise a variety of known toxic substances, and are a major contributor to atmospheric haze and visibility problems. Activities include evaluation of dust conditioning techniques, modification of charging sections and collecting electrodes for electrostatic precipitators, and evaluation of special operating techniques and filter fabrics to extend the capability of baghouses. In addition, novel concepts of particulate collection are being evaluated for performance and cost.

Nearly 70 contractors, grantees and consultants are currently working with CSL to develop particulate control technology as rapidly as possible. A systems study of conventional electrostatic precipitators (ESPs) has been published in an ESP Handbook, and a systems study of wet ESPs is scheduled for completion this year. Other documents which have been prepared in this area under CSL direction include a wet scrubber handbook and a fabric filter handbook. A handbook documenting a systems study of wet scrubber entrainment separators is in preparation.

• AUXILIARY PROGRAMS

CSL has efforts underway to acquire source assessment data relating the characteristics of hazardous, toxic and other pollutant emissions to their probable impact on receptors in order to define control technology development needs. The sources include industrial and utility combustion sources, non-combustion industrial processes, and open-burning sources. A listing of source priorities has been established and sources have been selected for which initial Source Assessment Documents are now being developed. These documents will consider the environmental impact of identified pollutants and present information necessary to allow decisions to be made by CSL personnel as to control development needs for the source types under consideration.

Evaluation and development of sampling and analytical procedures supports assessment of problem areas, evaluation of control technologies and the development of advanced control technologies. CSL is involved in detailing currently available techniques and developing new methods for sampling, measurement and analysis. The overall program area is balanced between process stream measurement and analysis, and specialized air pollution emission measurements. Several handbooks have been completed detailing manual methods for sampling and

analyzing gaseous pollutants, reviewing instrumental methods for measuring gases, and review methods for determination of particulate mass and size. In the area of particle measurement systems, a stack sampler which increases accuracy, minimizes sampling time, and is especially applicable to gas streams with low grain loadings was commercially packaged under contract. Studies are being implemented to develop an even higher volumetric rate sampler in support of the development of very high efficiency control devices.

A significant auxiliary program within the Laboratory is concerned with disseminating the large volume of information generated by its research, development and demonstration projects. For about 7 years, CSL has sponsored symposia, conferences, briefings, etc. in key areas such as flue gas desulfurization, clean fuels, particulate control, and combustion modification techniques for SO_x control and for NO_x control. About 25 such information exchanges have taken place and a number are planned within the near future. CSL personnel publish about 60 papers per year for presentation in EPA sponsored and co-sponsored symposia, technical and industrial association symposia, and institutional symposia. In addition, as indicated throughout this article, CSL RD&D has led to the publication of numerous (nearly 90 in 1974) handbooks, manuals, and technical reports which are available to potential users of the technologies.

A report containing titles, etc. of contract, grant, in-house (including symposia proceedings), and interagency reports covering air pollution RD&D work sponsored by CSL and other EPA organizations is prepared semi-annually and includes instructions for obtaining the documents. Additionally, CSL prepares a monthly report of abstracts representing CSL reports which have been issued but not yet included in the overall EPA report of air pollution technical publications. These documents are made available to interested parties. CSL is currently formulating a program to intensify efforts to disseminate, to industry and regulatory agencies, technical and economic information derived from its RD&D programs in order to accelerate commercial application of control technology.

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 your EPA Regional Technology Transfer Committee Chairman from the list below:

REGION	CHAIRMAN	ADDRESS
I	Lester Sutton	Environmental Protection Agency John F. Kennedy Federal Building Room 2304 Boston, Massachusetts 02203 617 223-2226 (Maine, N.H., Vt., Mass., R.I., Conn.)
II	Robert Olson	Environmental Protection Agency 26 Federal Plaza New York, New York 10017 212 264-1867 (N.Y., N.J., P.R., V.I.)
III	Albert Montague	Environmental Protection Agency 6th & Walnut Streets Philadelphia, Pennsylvania 19106 215 597-9856 (Pa., W. Va., Md., Del., D.C., Va.)
IV	Asa B. Foster, Jr.	Environmental Protection Agency Suite 300 1421 Peachtree Street, N.E. Atlanta, Georgia 30309 404 526-3454 (N.C., S.C., Ky., Tenn., Ga., Ala., Miss., Fla.)
V	Clifford Risley	Environmental Protection Agency 230 S. Dearborn St. Chicago, Illinois 60604 312 353-8880 (Mich., Wis., Minn., Ill., Ind., Ohio)
VI	Mildred Smith	Environmental Protection Agency 1600 Patterson Street, Suite 1100 Dallas, Texas 75201 214 749-1885 (Texas, Okla., Ark., La., N. Mex.)
VII	John Coakley	Environmental Protection Agency 1735 Baltimore Avenue Kansas City, Missouri 64108 816 374-5971 (Kansas, Nebr., Iowa, Mo.)
VIII	Russell Fitch	Environmental Protection Agency 1860 Lincoln Street Denver, Colorado 80203 303 837-3849—837-3691 (Colo., Mont., Wyo., Utah, N.D., S.D.)
IX	William Bishop	Environmental Protection Agency 100 California Street San Francisco, Calif. 94111 415 556-4806 (Calif., Ariz., Nev., Hawaii)
X	John Osborn	Environmental Protection Agency 1200 6th Avenue Seattle, Washington 98101 206 442-1296 (Wash., Ore., Idaho, Alaska)

For the following audio-visual material, please contact your Regional Technology Transfer Chairman. (See above)

MOTION PICTURES (16mm sound)

- Richardson Texas Project—Title: "Somebody around here must be doing something good." (15 min.)
- Phosphorus Removal (5 min.)
- Water Quality Management, Alameda Creek, Calif.—Title: "The Water Plan." (28½ min.)
- The Seattle METRO Story. (28 min.)

VIDEOTAPES

- Carbon Adsorption. (40 min.)
- Upgrading Activated Sludge Treatment Plants. (40 min.)

REQUEST FOR TECHNOLOGY TRANSFER MATERIAL

The publications listed on this form are the only ones available through the Office of Technology Transfer.

Please send me the following publications at no charge. (Check appropriate boxes)

PROCESS DESIGN MANUALS

- ☐ Phosphorus Removal 1001
- ☐ Carbon Adsorption 1002
- ☐ Suspended Solids Removal 1003
- ☐ Upgrading Existing Wastewater Treatment Plants 1004
- ☐ Sulfide Control in Sanitary Sewerage Systems 1005
- ☐ Sludge Treatment and Disposal 1006

TECHNICAL CAPSULE REPORTS

- ☐ Recycling Zinc in Viscose Rayon Plants 2001
- ☐ Color Removal from Kraft Pulping Effluent by Lime Addition 2002
- ☐ Pollution Abatement in a Copper Wire Mill 2003
- ☐ First Interim Report on EPA Alkali SO_2 Scrubbing Test Facility 2004
- ☐ Dry Caustic Peeling of Peaches 2005
- ☐ Pollution Abatement in a Brewing Facility 2006
- *☐ SO_2 Scrubbing and Sulfuric Acid Production Via Magnesia Scrubbing 2007
- *☐ Second Interim Report on EPA Alkali Scrubbing Test Facility 2008
- *☐ Magnesium Carbonate Process for Water Treatment 2009

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

MUNICIPAL SEMINAR PUBLICATIONS

- ☐ Upgrading Lagoons 4001
- ☐ Physical-Chemical Treatment 4002
- ☐ Oxygen Activated Sludge 4003
- ☐ Nitrification/Denitrification 4004
- ☐ Upgrading Existing Wastewater Treatment Facilities—Case Histories 4005
- ☐ Flow Equalization 4006
- ☐ Wastewater Filtration 4007
- ☐ Physical-Chemical Nitrogen Removal 4008

BROCHURES

- ☐ Physical-Chemical Treatment 5001
- ☐ Phosphorus Removal 5002
- ☐ Upgrading Existing Wastewater Treatment Plants 5003
- ☐ Carbon Adsorption 5004
- ☐ Oxygen Aeration 5005
- ☐ Nitrogen Control 5006
- ☐ Seattle, Washington METRO 5007
- ☐ Wastewater Purification at Lake Tahoe 5008
- ☐ Indian Creek Reservoir 5009
- ☐ Richardson, Texas 5010

HANDBOOKS

- ☐ Analytical Quality Control in Water and Wastewater Laboratories 6001
- ☐ Monitoring Industrial Wastewater 6002
- ☐ Methods for Chemical Analysis of Water and Wastes 6003

*Publication listed for first time

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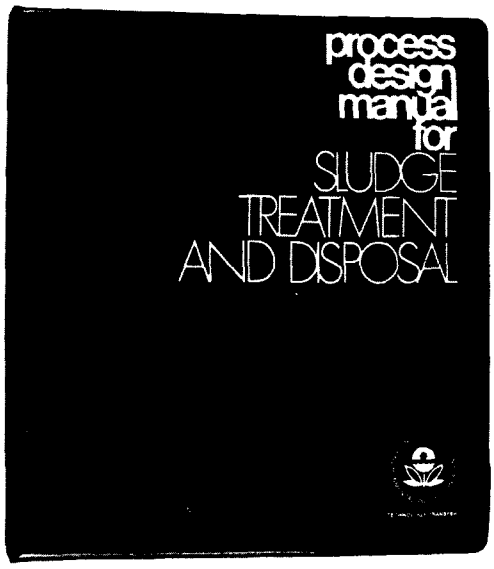
From left to right: John Green, USEPA Region VIII Administrator; Robert E. Crowe, Director of Technology Transfer, Washington, D. C.; Russell E. Train, USEPA, Administrator, Washington, D. C.; and James Smith, USEPA, NERC, Cincinnati, at the Water Pollution Control Federation Conference, Denver, Colorado.

TECHNOLOGY TRANSFER SLUDGE MANUAL INTRODUCED AT DENVER

The new Technology Transfer Process Design Manual for Sludge Treatment and Disposal was introduced this past October in Denver at the 47th Annual Conference of the Water Pollution Control Federation. The manual was distributed at the Technology Transfer exhibit area to more than 5,000 engineers, scientists, and other professionals attending the conference. The manual was enthusiastically received at the conference and several thousand additional requests for copies have been received through the mail indicating again the need for comprehensive manuals of this type. A copy of the manual may be ordered by using the request form at the rear of this publication.

Refer to inside last page of this publication for complete listing of current Technology Transfer publications.

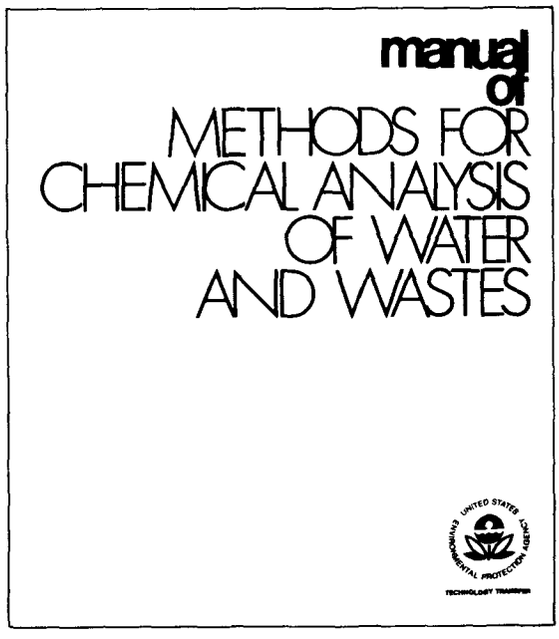
A highlight at the Technology Transfer exhibit was the visit of EPA Administrator, Mr. Russell Train, following his address to the conferees on October 9.



EPA CHEMICAL METHODS MANUAL AVAILABLE

A revision of the 1971 "Methods for Chemical Analysis of Water and Wastes" is now available for general distribution. This official EPA methods manual contains procedures for the chemical measurements required under Sec. 304(g) of PL 92-500 for use in the National Pollutant Discharge Elimination System (NPDES). A number of new methods are also included in the 1974 revision. When possible, precision and accuracy data obtained through interlaboratory studies are provided as part of the methods writeups. In addition, a new table of recommended sample preservation techniques and holding times are included in the introductory material of the manual.

This methods manual represents the joint efforts of the senior chemists of the EPA Methods Development and Quality Assurance Research Laboratory (MDQARL) working in close cooperation with other scientsts from E.P.A., state and municipal governments, and key representatives from private industry. Copies may be obtained on request to the Office of Technology Transfer, Washington, D.C. 20460.

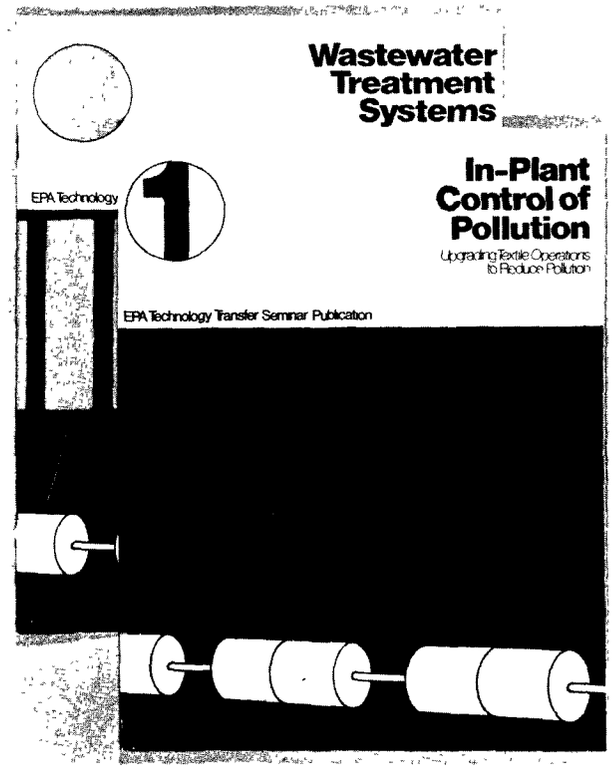


INDUSTRIAL SEMINAR PUBLICATIONS ON UPGRADING TEXTILE OPERATIONS TO REDUCE POLLUTION NOW AVAILABLE

A two-part publication covering In-Process Modification and Pretreatment and Waste Treatment is now available. These publications follow others developed from the seminar program where technical sessions were given covering the above topics. Previous publications were on Reducing Pollution in the Metal Finishing Industry, the poultry industry and the meatpacking industry.

The publications are particularly oriented toward owners, managers, superintendents, and engineering and operating staffs of textile manufacturing facilities. The seminars and the publications are intended to inform the small industry of the varied in-plant process modifications and control alternatives available to meet environmental standards. Addressing these topics should help the facility formulate their control alternatives prior to detailed design considerations.

To order these publications, use the order form at the rear of this publication.



METAL FINISHING SEMINAR

The seventh in a series of Technology Transfer seminars on "Upgrading Metal Finishing Facilities to Reduce Pollution" was held in **Atlanta, Georgia,** on the 20th & 21st of November.

The first session of the seminar featured a welcome address by Jack E. Ravan, Regional Administrator of EPA Region IV. and James Voytko of the American Electroplaters Society. Following these addresses, George Harlow, Chief, Water Enforcement Branch, discussed the EPA Permit Program and how it impacts the metal finishing industry, and Quentin H. Pickering of the EPA Newtown Fish Toxicology Station gave a presentation on the effects of Heavy Metals on the Aquatic Environment.

The first major technical session covering In Process Pollution Abatement was presented by Alan E. Olsen of Oxy Metal Finishing and Ed Hanf of the Culcote Company. This session covered in-plant water reduction, waste load reduction, spill prevention and control, and air emission control.

Mr. Gordon Culp, President of Clean Water Consultants, addresses audience at Municipal Design Seminar.

The session on Waste Treatment Systems was presented by Dr. Leslie E. Lancy and Fred Steward of Lancy Laboratories. This session included a review of the proven waste treatment alternatives as well as a presentation by Dr. Lancy on Liquid-Solid Separation, Solids Concentration and Sludge Disposal.

The final session featured a presentation on Optimum Financial Strategy by Charles R. Marshall of J. A. Commins and Associates and a review of the EPA Demonstration Grant Program by John Ciancia of the Edison Water Quality Laboratory. In this session John Ciancia covered the status of emerging technology for treatment of metal finishing wastes.

MUNICIPAL DESIGN SEMINARS

Four additional Technology Transfer municipal design seminars have been conducted in various areas of the country since the October 1, 1974, newsletter was published. These were presented in Dallas, Texas—November 5-6; Denver, Colorado—November 12-13; Chicago, Illinois—November 14-15; and Boise, Idaho—November 19-20.

The **Dallas, Texas,** seminar included technical sessions on sludge treatment and disposal, upgrading lagoons, and oxygen aeration. The sludge treatment session was given for the first time in Region VI and was very well received with a good question/answer session following the technical presentations.

The **Denver, Colorado,** seminar and the **Chicago, Illinois,** seminar were conducted during the same week and both covered sludge treatment and disposal and nitrogen control. These two seminars were the first in the Technology Transfer series to feature both sludge treatment and nitrogen control together in two one-day sessions.

The **Boise, Idaho,** seminar included technical sessions on upgrading existing wastewater treatment plants, physical-chemical treatment, and upgrading lagoons. The first day was devoted entirely to upgrading of existing trickling filter plants and activated sludge plants. A presentation of wastewater filtration was also included. Several case histories were discussed in detail.

Key presentations at the above seminars were given by Gordon Culp, Clean Water Consultants; Denny Parker and Warren Uhte, Brown and Caldwell; Gene Suhr, CH_2M/Hill; Ariel Thomas, Metcalf & Eddy; Curt McDowell, Air Products; Jim Laughlin, Shimek, Roming, Jacobs & Finklea; Bob Baumann, Iowa State University; Joe Rizzo, Calgon; Joe Middlebrooks and Jim Reynolds, Utah State University; and Clair Sawyer. EPA participants included Jim Smith, Ed Barth, Don Ehreth, Dick Brenner, Jim Westrick, and Jon Dyer.

MONITORING SEMINARS

Technology Transfer held five more seminars for industry on Monitoring Industrial Wastewater. Each of these seminars was attended by 300 plant managers and engineers. Dates and locations of the Monitoring seminars were:

October 1, 1974—**Concord, New Hampshire**
October 3, 1974—**New York City, N. Y.**
November 12, 1974—**Atlanta, Georgia**
December 10, 1974—**Portland, Oregon**
December 12, 1974—**San Francisco, Calif.**

The morning session of these seminars covered EPA regulatory policy with regard to the

monitoring requirements of PL 92-500. States within respective EPA regional offices presented their relationships to the Federal Program with regard to monitoring policies and requirements.

The afternoon sessions offered technical guidance for implementing a monitoring program. Dr. Wesley Eckenfelder of Vanderbilt University and AWARE, Inc. concentrated on an overview of Monitoring Industrial Wastewater. Dr. Phillip Shelley of Hydrospace-Challenger discussed Sampling The session on Flow Measurement was presented by Vic Jelen of the EPA Cincinnati Field Investigation Center. The session on Analytical Quality Control was prepared by Robert Booth of the EPA Cincinnati Methods Development and Quality Assurance Research Laboratory. The final session on In-Process Monitoring was presented by Walter Zabban of Chester Engineers.

TECHNOLOGY TRANSFER/AICHE CO-SPONSOR THE 2ND NATIONAL CONFERENCE ON COMPLETE WATER REUSE (WATER'S INTERFACE WITH ENERGY, AIR AND SOLIDS)

Technology Transfer and the American Institute of Chemical Engineers will jointly sponsor their 2nd National Conference on Complete Water Reuse to be held at the Palmer House, May 4-8, 1975, in **Chicago, Illinois.**

The Conference will bring together government, industry, management, and environmental personnel to consider and evaluate the meaning and potential for complete water reuse systems to fulfill the objective of Public Law 92-500 for Zero Discharge of Pollutants, and Water's Interface with Energy, Air and Solids.

POLLUTION CONTROL SEMINAR FOR THE TEXTILE INDUSTRY

Technology Transfer held its second industrial seminar for the Textile Industry entitled "Upgrading Textile Operations to Reduce Pollution" in **Boston, Massachusetts,** on January 15 & 16, 1975.

Opening remarks were made by John A. S. McGlennon, Regional Administrator, Region I, and John A. Stewart of the Northern Textile Association.

The first general session of the seminar covered EPA regulatory policy, the effects of textile mill discharges on the aquatic environment and the basics of pollution control.

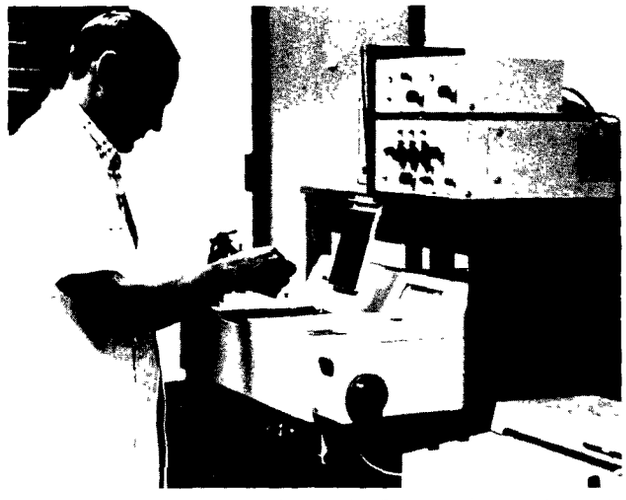
Three technical sessions were given covering in-plant control of pollution, pretreatment of textile wastes, and waste treatment systems. The session on in-plant control was prepared by the Institute of Textile Technology with the assistance of technical experts from industry. The session on treatment systems was prepared by Metcalf and Eddy, Inc., with the participation of Dr. Clair Sawyer, Dr. Ronald Sharpin, and Mr. Donald Hager.

The final session included financial strategies for pollution control investments presented by Charles Marshall of J. A. Commins & Associates, the EPA Demonstration Grant Program for the Textile Industry presented by Thomas Sargent of the EPA Laboratory at Athens, Georgia, and a key-note address on effective government-industry relationships by Wallace Storey of the American Textile Manufacturers Institute.

METHODS DEVELOPMENT AND QUALITY ASSURANCE RESEARCH LABORATORY

NATIONAL ENVIRONMENTAL RESEARCH CENTER, CINCINNATI, OHIO

The EPA laboratory in Cincinnati is responsible for the development, selection, and evaluation of



Measurements being taken at Spectrophotometer at Methods Development and Quality Assurance Research Laboratory.

methods for the analysis of water and wastewater and the development of quality control systems for evaluating and maintaining the reliability of laboratory data. Agency test procedures for the National Pollution Discharge Elimination System, the monitoring of water quality, and the identification and measurement of toxic pollutants are the special responsibilities of the laboratory staff. Because of EPA concern for data used in decision making and regulatory actions, an active program of quality assurance has been initiated throughout the Agency laboratories. Other laboratories providing results on waste discharges and water quality are also within the scope of the quality assurance program.

Five branches compose the laboratory organization. These are:

- Physical and Chemical Methods
- Biological Methods
- Instrumentation Development
- Radiochemistry and Nuclear Engineering
- Quality Assurance and Laboratory Evaluation

The Physical and Chemical Methods Branch has sections for Inorganic, Organic, and Advanced Instrumental Analyses. The Inorganic laboratory group is responsible for research leading to improved techniques for mineral, nutrient, and heavy metal constituents in water and wastewaters. Emphasis is on rapid instrumental approaches including automated analysis, specific ion electrodes, and combustion procedures for organic carbon and trace metals. The current demand for reliable methods for waste monitoring at the low concentrations consistent with adequate treatment is a special challenge for this section.

Organic methods research involves procedures for a wide variety of industrial organic chemicals in effluents, including known and potentially carcinogenic materials. Reliable methods for new pesticides and herbicides, for the identification of spilled oil in rivers, lakes, and estuaries, and the characterization and measurement of trace organics in water supplies are urgently needed. Precise determinations and unambiguous identifications are required for regulatory actions by the Agency.

The Advanced Instrumentation Section deals with the application of sophisticated systems for laboratory analysis. Instruments which at present may be available only to relatively large laboratories can become routine equipment through application studies and systems design. An example of this is the gas chromatograph/mass spectrometer, which has become a standard tool in EPA for organic identifications. The Advanced Instrumentation Section develops and expands these types of instruments, providing methodology to other laboratories of the Agency. The Section is also involved in the development of a computerized system for laboratory automation which will form the basis for more rapid, reliable sample processing, analysis, and data handling in EPA regional laboratories.

In the area of natural sciences, the Biological Methods Branch, through its Virology, Microbiology, and Aquatic Biology Sections, seeks to improve procedures for the collection, enumeration, and identification of micro and macro organisms in water supplies, ambient waters, and municipal wastes. The importance of viruses as health hazards to humans requires ability to rapidly isolate and quantify these organisms in a variety of environmental media. Present methods are tedious and time consuming and the Virology Section is committed to the development of improved and standarized laboratory procedures which will permit rapid assessment of hazard. These procedures must be capable of isolating a few microorganisms in large quantities of water, because of the likelihood of disease transmission by relatively low numbers of viruses.

Effluent standards and water quality criteria include limitations on the number of "indicator" organisms (total and fecal coliforms) which may be present. The Microbiological Section is responsible for improved techniques for the enumeration of these organisms, as well as pathogens such as salmonella. The emphasis is on rapid procedures which can be used in laboratories with limited technical personnel. The development of quality assurance techniques to assure reliable microbiological data is also the concern of this section.

The Aquatic Biology Section develops and evaluates methods for use by Agency biologists in field and laboratory studies carried out to detect violations of water quality standards, evaluate the trophic status of surface waters, determine long-term trends in surface water quality, and measure the toxicity of specific pollutants or effluents to individual species or communities of aquatic organisms. The methodology developed by this section includes: sample collection, sample processing and counting, identification of aquatic organisms; biomass determinations; measurement of metabolic rates; measurement of toxicity, bioaccumulation and biomagnification of pollutants; and biological data processing and evaluation.

The Instrumentation Development Branch is responsible for the research on new monitoring instrumentation for water and wastes and for the evaluation of commercially available effluent monitoring equipment. Emphasis is placed on instruments which will measure one or more constituents of the waste on a continuous basis and record the data for later analysis or transmit the information to a central station. The reliability of the equipment is evaluated under environmental stress in the testing laboratory, then installed in an actual monitoring mode for further examination. The ultimate objective is to guide the Agency in the selection of its own monitoring instruments and to determine the usefulness of data submitted by a discharger when similar equipment is used. Through the testing of a variety of instruments the most desirable design and operation can be identified, leading to detailed specifications and guidelines for future equipment procurement and utilization. In its evaluation program, the measurement principle, the sensor design, the internal electronic configuration, and the data processing and transmission capabilities are assessed. The Branch has the facilities and staff to examine each component individually and collectively and to identify the strengths and weaknesses of in-

strument design ad operation. Evaluation reports are prepared and published on each instrument tested.

Because of the increasing use of nuclear reactors for power generation, methods for the assessment of environmental impact of reactor operations and waste handling are necessary. The Radiochemistry and Nuclear Engineering Branch is charged with selecting, developing and demonstrating analytical methods for radionuclides in a variety of environmental media. The staff of the Branch studies the transport of radionuclides in the vicinity of reactors and makes field studies to define the impact of proposed new nuclear power plants and nuclear fuel processing facilities. Procedures for the accurate measurement of the amount and types of radionuclides in plant effluents are developed and standardized by the Branch. Technical assistance is provided to other elements of EPA in the assessment of radioactivity levels in the environment.

A variety of activities related to improving and monitoring the quality of laboratory data are carried out by the Quality Assurance and Laboratory Evaluation Branch of MDQARL. Interlaboratory studies leading to the validation of Agency test procedures for water quality and waste constituents are conducted. These studies, utilizing many laboratories from the public and private sectors, provide data on the precision, accuracy, and dependability of approved methods and assist in the interpretation of monitoring data. Reports of these studies provide information to both analysts and decision makers and help to identify needed improvement in laboratory methodology.

The Branch develops intralaboratory quality control procedures to assure the reliability of analyses and data handling and provides check samples for the evaluation of analyst performance. A series of quality control samples are distributed by the Branch to laboratories engaged in water and waste analysis. These samples, available without charge, enable the laboratory to measure its performance against known pollutant levels and to highlight problem areas in analytical methods, equipment, or techniques.

Through both inhouse and extramural projects, the Quality Assurance and Laboratory Evaluation Branch develops systems for the evaluation of laboratories, including inspection forms, test protocols, check sample performance evaluations, and approval mechanisms. These systems, used to measure laboratory capabilities at the Federal, state, and local level, assist in establishing the reliability of environmental data banks. As presently conceived, these programs may lead to the approval of specific laboratories for environmental measurements required by current EPA regulatory activities.

The present staff of the MDQAR Laboratory numbers 90, of which 52 are professional scientists and engineers. At the present time the staff is in three separate buildings in Cincinnati, with the laboratory headquarters at 1014 Broadway. When the new National Environmental Research Center building is completed in October, the laboratory will be consolidated into the new and improved physical facility.

The MDQAR Laboratory has an increasing history. It was established in 1957 as the central laboratory for the National Water Quality Network of the U.S. Public Health Service. With the formation of the Federal Water Pollution Control Administration as the parent organization, and the transfer of surveillance responsibilities to regional offices, the laboratory assumed its present role as a research component under the title of Analytical Quality Control Laboratory. In September 1973, the present MDQARL was formed, as part of the National Environmental Research Center-Cincinnati, incorporating the old AQCL with virology and radiochemistry elements from other Cincinnati organizations.

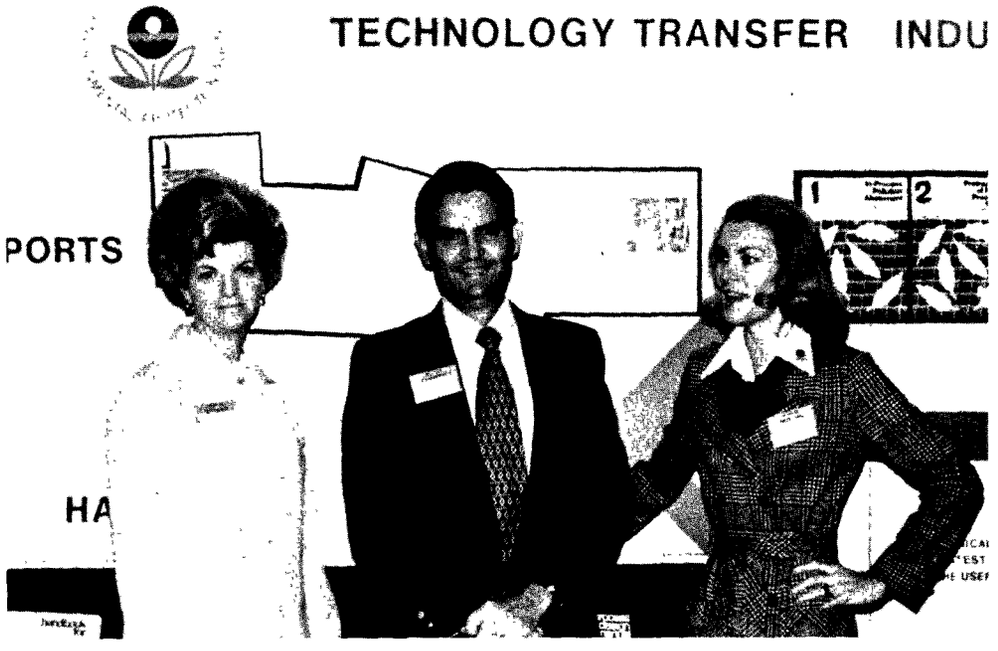
Throughout its history MDQARL has made significant contributions to the science of water and waste methodology. Among these are the application of the carbon absorption systems for monitoring organics, methods for chlorinated hydrocarbon pesticides, automated colorimetric analyses, use of the emission spectrograph for multielement measurements, procedures for the identification of oil, methods for the determination of mercury, the application of gas chromatography/mass spectrometer (GC/MS) to organic identification, the development of artificial substrates for the collection of aquatic organisms, the preparation and publication of taxonomic keys for organism identification, methods for the isolation and identification of viruses and pathogens in water, the publication of specifications for integrated water quality monitoring instruments and data transmission systems, and the conduct of definitive studies of the precision and accuracy of analytical methods.

Current research activities include improved methods for cyanide, phenols, pesticides, and other toxic pollutants, development of new techniques for GC/MS, quantitative detection of viruses, rapid methods for pathogens and indicator organisms, new and improved techniques for biological investigations, evaluation of effluent monitoring systems, measurement of gaseous radionuclides in the vicinity of nuclear facilities, validation of Agency methods for chemical and biological measurements, and the development of new check samples for a variety of laboratory programs.

In order to maintain awareness of standardization activities by other groups, the laboratory staff participates in the preparation of Standard Methods for the Examination of Water and Wastewater, Committees D-19, D-22, E-2, and E-36 of

ASTM, the International Standards Organization, and the World Health Organization.

A wide variety of publications, described in a brochure, are available from the laboratory. Among these are "Methods for Chemical Analysis of Water and Wastes" (described in another article in this Newsletter), "Biological Field and Laboratory Methods," "Methods for Organic Pesticides in Water and Wastewater," "Handbook for Analytical Quality Control in Water and Wastewater Laboratories," and a series of reports on method validation studies. The laboratory publishes and distributes its own newsletter, called "Analytical Quality Control." These publications and further information on laboratory activities may be obtained by writing to: Director, Methods Development and Quality Assurance Research, Laboratory, National Environmental Research Center, EPA, Cincinnati, Ohio 45268.



From left to right: Mrs. Pat Zweig, USEPA, Region IV; Mr. Asa Foster, USEPA, Region IV, Technology Transfer Chairman; and Mrs. Dianne Kilmer, USEPA, Region IV, Public Affairs Office, participate in the International Textile Exposition (ITEX '74) in Greenville, South Carolina.

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 your EPA Regional Technology Transfer Committee Chairman from the list below:

REGION	CHAIRMAN	ADDRESS
I	Lester Sutton	Environmental Protection Agency John F. Kennedy Federal Building Room 2304 Boston, Massachusetts 02203 617 223-2226 (Maine, N.H., Vt., Mass., R.I., Conn.)
II	Robert Olson	Environmental Protection Agency 26 Federal Plaza New York, New York 10017 212 264-1867 (N.Y., N.J., P.R., V.I.)
III	Albert Montague	Environmental Protection Agency 6th & Walnut Streets Philadelphia, Pennsylvania 19106 215 597-9856 (Pa., W. Va., Md., Del., D.C., Va.)
IV	Asa B. Foster, Jr.	Environmental Protection Agency Suite 300 1421 Peachtree Street, N.E. Atlanta, Georgia 30309 404 526-3454 (N.C., S.C., Ky., Tenn., Ga., Ala., Miss., Fla.)
V	Clifford Risley	Environmental Protection Agency 230 S. Dearborn St. Chicago, Illinois 60604 312 353-5756 (Mich., Wis., Minn., Ill., Ind., Ohio)
VI	Mildred Smith	Environmental Protection Agency 1600 Patterson Street, Suite 1100 Dallas, Texas 75201 214 749-1461 (Texas, Okla., Ark., La., N. Mex.)
VII	John Coakley	Environmental Protection Agency 1735 Baltimore Avenue Kansas City, Missouri 64108 816 374-5971 (Kansas, Nebr., Iowa, Mo.)
VIII	Russell Fitch	Environmental Protection Agency 1860 Lincoln Street Denver, Colorado 80203 303 837-3849—837-3691 (Colo., Mont., Wyo., Utah, N.D., S.D.)
IX	William Bishop	Environmental Protection Agency 100 California Street San Francisco, Calif. 94111 415 556-4806 (Calif., Ariz., Nev., Hawaii)
X	John Osborn	Environmental Protection Agency 1200 6th Avenue Seattle, Washington 98101 206 442-1296 (Wash., Ore., Idaho, Alaska)

REQUEST FOR TECHNOLOGY TRANSFER MATERIAL

The publications listed on this form are the only ones available through the Office of Technology Transfer. Please send me the following publications at no charge. (Check appropriate boxes)

PROCESS DESIGN MANUALS

- ☐ Phosphorus Removal 1001
- ☐ Carbon Adsorption 1002
- ☐ Suspended Solids Removal 1003
- ☐ Upgrading Existing Wastewater Treatment Plants 1004
- ☐ Sulfide Control in Sanitary Sewerage Systems 1005
- ☐ Sludge Treatment and Disposal 1006

TECHNICAL CAPSULE REPORTS

- ☐ Recycling Zinc in Viscose Rayon Plants 2001
- ☐ Color Removal from Kraft Pulping Effluent by Lime Addition 2002
- ☐ Pollution Abatement in a Copper Wire Mill 2003
- ☐ First Interim Report on EPA Alkali SO_2 Scrubbing Test Facility 2004
- ☐ Dry Caustic Peeling of Peaches 2005
- ☐ Pollution Abatement in a Brewing Facility 2006

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

MUNICIPAL SEMINAR PUBLICATIONS

- ☐ Upgrading Lagoons 4001
- ☐ Physical-Chemical Treatment 4002
- ☐ Oxygen Activated Sludge 4003
- ☐ Nitrification/Denitrification 4004
- ☐ Upgrading Existing Wastewater Treatment Facilities—Case Histories 4005
- ☐ Flow Equalization 4006
- ☐ Wastewater Filtration 4007
- ☐ Physical-Chemical Nitrogen Removal 4008

BROCHURES

- ☐ Physical-Chemical Treatment 5001
- ☐ Phosphorus Removal 5002
- ☐ Upgrading Existing Wastewater Treatment Plants 5003
- ☐ Carbon Adsorption 5004
- ☐ Oxygen Aeration 5005
- ☐ Nitrogen Control 5006
- ☐ Seattle, Washington METRO 5007
- ☐ Wastewater Purification at Lake Tahoe 5008
- ☐ Indian Creek Reservoir 5009
- ☐ Richardson, Texas 5010

HANDBOOKS

- ☐ Analytical Quality Control in Water and Wastewater Laboratories 6001
- ☐ Monitoring Industrial Wastewater 6002
- *☐ Methods for Chemical Analysis of Water 6003

* Publication listed for first time

For the following audio-visual material, please contact your Regional Technology Transfer Chairman. (See listing)

MOTION PICTURES (16mm sound)

- Richardson Texas Project—Title: "Somebody around here must be doing something good." (15 min.)
- Phosphorus Removal (5 min.)
- Water Quality Management, Alameda Creek, Calif.—Title: "The Water Plan." (28½ min.)
- The Seattle METRO Story. (28 min.)

VIDEOTAPES

- Carbon Adsorption. (40 min.)
- Upgrading Activated Sludge Treatment Plants. (40 min.)

If you are not currently on the mailing list for this Technology Transfer Newsletter, do you want to be added?
Yes ☐ No ☐
If you no longer wish to receive this fact sheet, check this box ☐

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Employer Title

Street Phone

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Note: Tear this sheet out and forward to Technology Transfer, U. S. Environmental Protection Agency, Washington, D. C. 20460

Detach this request sheet and mail in envelope to :

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TECHNOLOGY TRANSFER
The Bridge Between Research and Use

U.S. ENVIRONMENTAL PROTECTION AGENCY OCTOBER 1, 1974

NEW SLUDGE TREATMENT AND DISPOSAL DESIGN MANUAL TO BE FEATURED AT WPCF CONFERENCE

The EPA Technology Transfer Program will once again participate in the annual conference of the Water Pollution Control Federation being held this year in Denver, Colorado, in October.

The new Technology Transfer Process Design Manual for Sludge Treatment and Disposal will be introduced and distributed at the Denver meeting. There will be no charge for this new "blue book." The new sludge manual will be comprehensive in scope and include such topics as physical and chemical properties, thickening, stabilization, conditioning, dewatering, reduction, final disposal processes, and case studies. New chemical sludges and oxygen sludges will be covered in addition to the various types of equipment required to perform the basic processes. All new processes and equipment will be included as well as cost data and all applicable data and information from the EPA research and demonstration program.

Host region for this years conference will be EPA's Region VIII. John A. Green, the Regional Administrator, will be on hand at the opening of the conference, which annually attracts thousands of the nations top pollution experts.

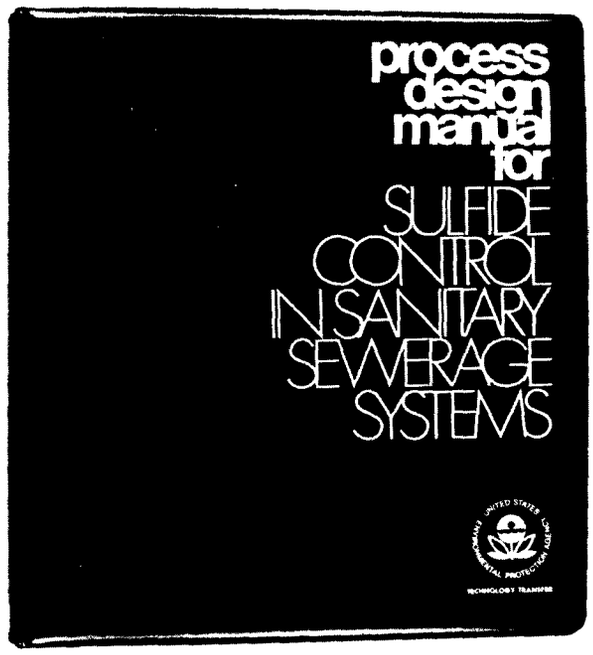
On October 3, 1971, John A. Green was appointed as the first Regional Administrator of the Environmental Protection Agency, Rocky Mountain-Prairie Region, by EPA National Administrator, William D. Ruckelshaus.

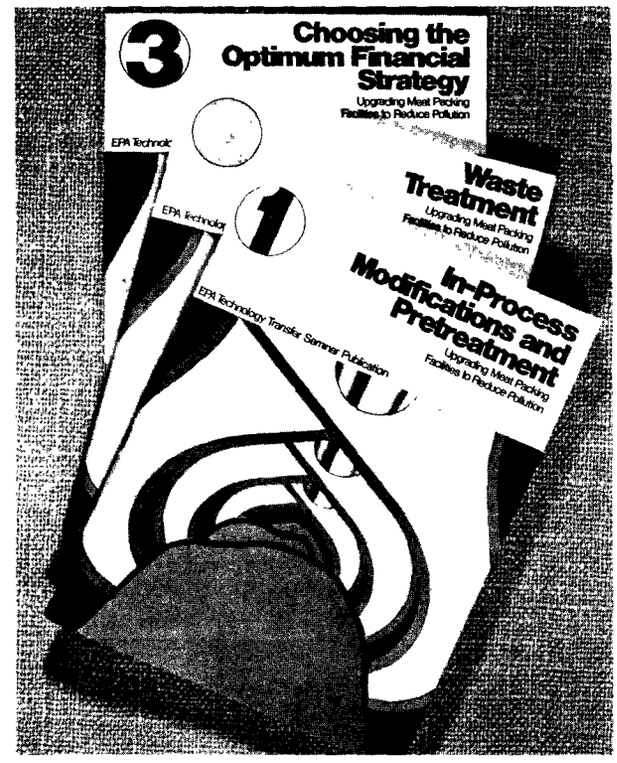
As Regional Administrator, Green is the highest level federal official concerned with protecting the environment in the states of Colorado, Utah, Montana, Wyoming, North Dakota, and South Dakota. He is responsible not only for the agency's leadership in environmental management, but, also, for planning and integrating important strategies and priorities in the six-state region. Green directs the development and administration of a coherent, unified approach to the interrelated problems of air and water pollution, pesticides, radiation, solid waste and noise.

Immediately prior to being appointed Regional Administrator, Green served as senior staff advisor to the EPA Assistant Administrator for Categorical Programs in Washington, D.C. Green was responsible for guiding the program's control of a wide variety of environmental contaminants, including pesticides, radiation, and solid waste.

John Green, EPA, Region VIII, Administrator.

Green has also served as Director of Management, Federal Water Quality Administration in Arlington, Virginia. As Director, Green supervised special studies aimed at improving the efficiency and effectiveness of the nation's "Clean Water" program as well as overseeing the development of a long-range strategy for the attainment, nationally, of the Federal Water Quality Standards.





SULFIDE CONTROL MANUAL AVAILABLE

The Technology Transfer Process Design Manual for Sulfide Control in Sanitary Sewerage Systems, prepared by Pomeroy, Johnston, and Bailey of Pasadena, California, is currently being distributed. This Manual includes information for all feasible alternative designs that can be used to control sulfides and minimize their effects in both new and existing sewerage systems.

Specific topics covered include: Characteristics and Properties of Hydrogen Sulfide; Occurrence and Effects of Sulfide in Sewers; Investigation in Existing Systems; and Design of Sewer Systems to Prevent Sulfide Problems. Case histories, examples, and cost estimates are presented to substantiate the "how-to" approach of this manual.

Individuals interested in obtaining, at no charge, a copy of the Sulfide Control Manual should fill out the appropriate form in the back of this publication and forward it to Technology Transfer, U.S. Environmental Protection Agency, Washington, D.C. 20460.

INDUSTRIAL SEMINAR PUBLICATIONS ON UPGRADING MEAT PACKING TO REDUCE POLLUTION NOW AVAILABLE

A three part publication covering In-Process Modification and Pretreatment, Waste Treatment, and Choosing the Optimum Financial Strategy is now available. These publications follow others developed from the seminar program where technical sessions were given covering the above topics. Previous publications were on Reducing Pollution in the Metal Finishing Industry and the Poultry Industry.

The publications are particularly oriented toward owners, managers, superintendents, and engineering and operating staffs of meat packing facilities. The seminars and the publications are intended to inform the small industry of the varied in-plant process modifications and control alternatives available to meet environmental standards. Addressing these topics should help the facility formulate their control alternatives prior to detailed design considerations.

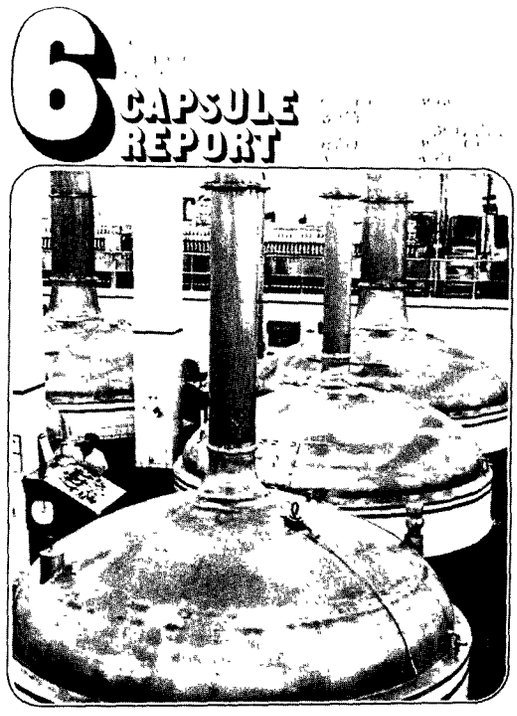
To order these publications, use the order form at the rear of this publication.

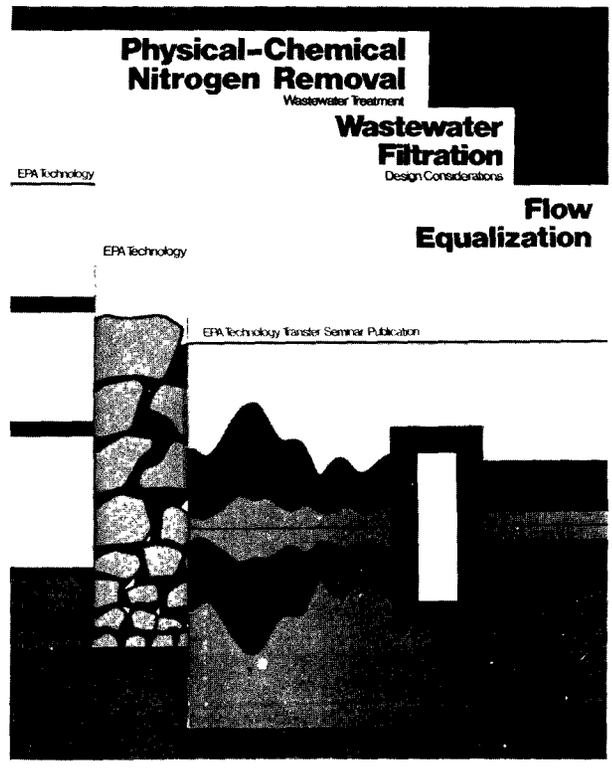
TECHNICAL CAPSULE REPORT ON POLLUTION ABATEMENT IN A BREWING FACILITY NOW AVAILABLE

A technical capsule report on the pollution abatement program progress Adolph Coors brewing facility at Golden, Colorado is now available.

The report spotlights the achievement made by Coors in waste reduction, water reuse, **and by-product recovery and utilization.** The report shows the significant savings that can be realized through a well planned and well executed environmental control and resource conservation program. Through these efforts Coors has realized a savings of more than $1,500,000 in treatment plant capital costs and a savings of nearly $1,500,000 per year in treatment plant operating costs. The success of the Coors environmental control program is due, to a great extent, to the strong support given by William K. Coors and his management staff.

The process design improvements and in plant





changes made by Coors to reuse water, reduce waste loads and recover by-products are directly applicable to other breweries as well as other food processing industries.

To order your copy of this capsule report, use the order blank on the back page.

NEW MUNICIPAL SEMINAR PUBLICATIONS AVAILABLE

Three new Technology Transfer municipal seminar publications have been published and are now available for distribution. These publications include material developed for the design seminar program and have been used throughout the country. The new seminar publications, which may be ordered by using the request form at the rear of this newsletter, include the following:

"Flow Equalization" by Metcalf & Eddy Engineers (Stanley Elkerton, primary author). This publication includes determination of equalization requirements, design and construction procedures, equalization impact on other treatment components, costs, and four selected case histories.

"Wastewater Filtration" by John Cleasby and Robert Baumann. This publication includes most aspects of filter design including filter configurations, methods of flow control, backwashing requirements, headloss development, and selection of filtration rates.

"Physical-Chemical Nitrogen Removal" by Culp, Wesner, and Culp (Gordon Culp primary author). Included in this publication are design considerations for the three feasible physical-chemical methods of nitrogen removal, i.e. selective ion exchange, ammonia stripping, and break point chlorination. Chapters include information on typical design criteria, pilot testing, case histories, costs, and basic comparison of the three processes.

MUNICIPAL DESIGN SEMINARS

Five additional Technology Transfer municipal design seminars have been conducted in various areas of the country since publication of the last newsletter. These were presented in Newark, New Jersey, March 13-15; San Juan, Puerto Rico, April 8-10; Orlando, Florida, May 7-9; Seattle, Washington, May 21-22, and Boston, Massachusetts, September 10-11.

The **Newark, N.J.** seminar included technical sessions on nitrogen control, upgrading existing wastewater treatment plants, and combined sewer overflows. The nitrogen control session was especially well received with Dr. Clair Sawyer covering biological nitrification and denitrification and Mr. Gordon Culp covering physical-chemical nitrogen removal. They were assisted by Mr. Don Ehreth of the EPA Office of R&D.

The **San Juan, P.R.** seminar included technical sessions on sludge treatment and disposal and upgrading existing trickling filter plants. In addition to the technical session, a general first day session covered the EPA municipal construction program, construction design guidelines and EPA regional grants program and procedures. EPA speakers at this session included Mr. Harold Cahill and Mr. Charles Sutfin of the Office of Water Programs Operations, and Mr. Rocco Ricci of EPA Region I. This seminar was held with the cooperation of the

Attendees of the Orlando, Florida, Seminar.

Puerto Rico Environmental Quality Board and the Puerto Rico Aqueduct and Sewer Authority.

The **Orlando, Fla.** seminar included sessions on oxygen aeration, nitrogen control and upgrading existing treatment facilities. The opening morning general session included discussions of user charges, construction guidelines, and municipal permits.

The **Seattle, Wash.** seminar featured two full day sessions on sludge treatment and disposal and infiltration/inflow control. The sludge session featured three of the key individuals involved in preparation of the forthcoming Technology Transfer sludge design manual (see story on 1st page); Dr. Jim Smith of the EPA National Environmental Research Center, Cincinnati; Mr. Jack Harrison of Black, Crow, and Eidness Engrs; and Mr. Gordon Culp of CWC Consultants.

The **Boston, Mass.** seminar featured the first full day nitrogen control session conducted at a T.T. seminar with presentations by Dr. Clair Sawyer, Dr. Denny Parker, Gordon Culp, Don Ehreth and Ed Barth. Technical sessions were also conducted on physical-chemical treatment and phosphorus removal.

Key presentations by other speakers at the above seminars were given by Dr. Denny Parker and Warren Uhte, Brown and Caldwell; Dr. Bob Baumann and Dr. Jack Cleasby, Iowa State University; Charles Hansen, Envirex; James Laughlin, Shimek, Roming, Jacobs & Finklea; Ariel Thomas, Metcalf & Eddy; Curt McDowell, Air Products; Mike Miller, Union Carbide; Bob Pfefferle and Tom Clark, American Consulting Service; and Jon Dyer, Ed Barth, Dick Field and Jesse Cohen from the EPA R&D staff.

SEMINAR SERIES POLLUTION ABATEMENT IN METAL FINISHING FACILITIES

The sixth in a series of Technology Transfer seminars on "Upgrading Metal Finishing Facilities to Reduce Pollution" was held in **Chicago, Illinois** on May 7-8, 1974.

The first session of the seminar featured a welcome address by Francis T. Mayo, Administrator for EPA's Region V, and an address by Simon P. Gary of the American Electroplaters Society on the impact of the Water Pollution Control Act on the plating industry. Following these addresses, Quentin H. Pickering of the EPA Newtown Fish Toxicology Station gave a presentation on the effects of Heavy Metals on the Aquatic Environment.

The first major technical sessions covering In Process Pollution Abatement was presented by Alan E. Olsen of Oxy Metal Finishing and Ed Hanf of the Culcote Company. This session covered in-plant water reduction, waste load reduction, spill prevention and control, and air emission control.

The sessions on Waste Treatment Systems was presented by Dr. Leslie E. Lancy and Fred Steward of Lancy Laboratories. This session included a review of the proven waste treatment alternatives as well as a presentation by Dr. Lancy on Liquid-Solid Separation Solids Concentration and Sludge Disposal.

The final session featured a presentation on Optimum Financial Strategy by Charles R. Marshall of J. A. Commins and Associates and a review of the EPA Demonstration Grant Program by John Ciancia of the Edison Water Quality Laboratory. In this

session John Ciancia covered the status of emerging technology for treatment of metal finishing wastes.

POLLUTION CONTROL SEMINAR FOR THE SEAFOOD INDUSTRY

Technology Transfer in cooperation with the National Fisheries Institute and the National Canners Association held its first two seminars for the seafood processing industry entitled "Upgrading Seafood Processing Facilities to Reduce Pollution" in **New Orleans, La.** on May 5-6, 1974, and in **Seattle, Washington** on April 2-3, 1974.

The seminars featured addresses by Roy Martin of the National Fisheries Institute and Allen Katsuyama of the National Canners Association.

The emphasis for the two-day seminars was on the sessions concerning In-Plant Control of Wastes and Waste Treatment Systems. The session on In-Plant Control featured Dr. George Piggott of the University of Washington's Institute for Food Science. The session on waste treatment featured Michael Soderquist of Environmental Associates, Inc. The treatment session included informative presentations on the latest progress in waste treatment demonstration projects, presented by Fred G. Claggett of Canada's Envrionmental Protection Service, A. Frank Mauldin of Dorminique, Szabo and Associates, and Irwin F. Snyder of Carborundum Envrionmental Systems, Inc.

The seafood processing industry was represented by Roy Martin of the National Fisheries Institute in his talk on Future Considerations of Seafood Technology, and by Allen Katsuyama of the National Canners Association in his talk on Effective Government-Industry Relationships to Control Pollution.

The final session of the seminars featured presentations on Optimum Financing Strategy by Charles R. Marshall of J. A. Commins and Associates, and a discussion on the EPA Demonstration Grant Program by Kenneth Dostal and Harold Thompson of the EPA Waste Treatment Research Program in Corvallis, Oregon.

MONITORING AND TOXIC SUBSTANCES CONTROL SEMINARS

Technology Transfer held its first seminars for industry on Monitoring Industrial Wastewater and Toxic Substances Control in **Atlanta, Georgia** on April 18 and 19, 1974.

The Monitoring Seminar, attended by 300 plant managers, featured a welcome address by John C. White, EPA Deputy Regional Administrator.

The morning session of the seminar covered EPA regulatory policy with regard to the monitoring requirements of PL 92-500. Florida, Kentucky,

Audience at Technology Transfer Monitoring Seminar held in Atlanta, Georgia.

Asa Foster, Technology Transfer Chairman for Region IV, addresses Monitoring Seminar in Atlanta. Seated from left to right are. Wesley Eckenfelder, of Aware, Inc, and Walter Zabban, of Chester Engineers.

Charles Sercu of Dow Chemical addresses Atlanta Technology Transfer Seminar on Toxic Substances Control.

Georgia, Mississippi, North Carolina, South Carolina, and Tennessee presented the states' relationship to the Federal Program.

The afternoon session offered technical guidance for implementing a monitoring program. Dr. Wesley Eckenfelder of Vanderbilt University and AWARE, Inc. concentrated on an overview of Monitoring Industrial Wastewater. Dr. Phillip Shelly of Hydrospace-Challenger discussed Sampling. The session on Flow Measurement was presented by Vic Jelen of the EPA Cincinnati Field Investigation Center. The session on Analytical Quality Control was prepared by Robert Booth of the EPA Cincinnati Methods Development and Quality Assurance Research Laboratory. The final session on In-Process Monitoring was presented by Walter Zabban of Chester Engineers.

The Toxic Substances Control seminar was presented on the following day. The first session was devoted to presenting an overview of the Toxic Substances Provisions of PL 92-500 and EPA's regulatory policy toward Toxic Substances.

The final morning session was a presentation on how permits are processed for toxic substance discharges.

The second session was designed to present to the participants of the seminar a comprehensive discussion on Guidance for Implementing a Control Program. Charles Sercu of Dow Chemical Company began this session with a talk on Industry's Responsibilities in Toxic Pollutant Effluent Standards. Donald A. Baehl of Union Carbide Corporation prepared the session on Minimizing Toxics in Effluents by Process Design and In-Plant Operating Practices. The next presentation was by Don Hager of Calgon Corporation who discussed Activated Carbon Adsorption of Aldrin, Diedrin, Endrin, PCB's, DDT and Toxaphene. The session on the Control of Cadmium and Cyanide was prepared by Alan E. Olsen of OXY Metal Finishing.

Control of Benzidene was the subject of the next session by Thomas Kopp of EPA's Office of Toxic Substances.

Dr. Lloyd Falk of DuPont Corporation completed the seminar with a presentation on Dispersion Techniques.

NEW TECHNOLOGY TRANSFER MOTION PICTURE AVAILABLE— "THE SEATTLE METRO STORY"

Another motion picture is now available through the Technology Transfer Program. The 28 minute, 16 mm color sound film depicts the development of Seattle, Washington METRO interceptor system and treatment facilities and their role in abating pollution of Puget Sound and Lake Washington. The film features the phosphorus removal facilities at the Rentin treatment plant; computer control of combined flow overflows in the interceptor system; use of sludge from the plant centrifuges as landfill; and development and formation of the METRO itself. The film was made possible by the cooperation and efforts of the Seattle METRO staff and the EPA Region X staff in Seattle.

Requests for loan of this film, and other Technology Transfer films listed on the request form at the rear of this newsletter, may be made to the appropriate Technology Transfer Regional Chairman also listed at the rear of this publication.

Left to right: Dennis Cannon, Paul Minor and Jim Truett of the Technology Transfer Staff participating in the WWEMA Conference

TECHNOLOGY TRANSFER PARTICIPATES IN WWEMA CONFERENCE AND EXPOSITION

Technology Transfer participated in the Waste Water Equipment Manufacturers Association (WWEMA) annual meeting in **Detroit** on April 1-4, 1974, with a presentation of Technology Development by Paul Minor and an exhibit featuring the industrial seminar publications for the meat packing, metal finishing and poultry industries, the industrial technical capsule reports and the Handbook on Monitoring Industrial Wastewater.

FUTURE MONITORING SEMINARS

A Monitoring Industrial Wastewater Seminar was held on April 18, 1974, in Atlanta. See article on page 5 of this Newsletter. This seminar was an overwhelming success as measured by the attendance, and feedback obtained since the seminar. Technology Transfer is planning to present 10 additional Monitoring seminars - one in each EPA Region - during this fiscal year. Final dates and locations have not yet been finalized. If you are interested in attending one of these seminars, contact your Regional Technology Transfer Chairman listed in this Fact Sheet.

TEXTILE SEMINAR PUBLICATIONS FEATURED AT THE INTERNATIONAL TEXTILE EXPOSITION

Technology Transfer will provide an exhibit at the International Textile Exposition (ITEX) in Greenville, South Carolina on October 21-25, 1974. The exhibit will feature the distribution of a two part publication series on "Upgrading Textile Operations to Reduce Pollution" which were developed for the Technology Transfer seminar for the textile industry. The publications cover "In-Plant Control of Pollution" and "Wastewater Treatment Systems". Volume one on In-Plant Control was prepared under the direction of the Institute of Textile Technology by experts within the Textile industry. Volume two on waste treatment was prepared by Metcalf & Eddy Inc., consulting engineers.

Asa B. Foster Jr., Technology Transfer Chairman for EPA Region IV in Atlanta and several Regional representatives will participate in the ITEX exhibition.

For your copy of these publications, use the order form on the back of this newsletter.

FLOW EQUALIZATION*

GENERAL

The primary objective of flow-equalization basins for municipal wastewater plants is simply to dampen the diurnal flow variation, and thus achieve a constant or nearly constant flow rate through the downstream treatment processes. A desirable secondary objective is to dampen the concentration and mass flow of wastewater constituents by blending the wastewater in the equalization basin. This results in a more uniform loading of organics, nutrients, and other suspended and dissolved constituents to subsequent processes.

Through achieving these objectives, flow equalization can significantly improve the performance of an existing treatment facility, and is a useful upgrading technique. In the case of new plant design, flow equalization can reduce the required size of downstream facilities.

Variations Of Flow Equalization

Equalization of municipal wastewater flows may be divided into three broad categories:

- Equalization of dry weather flows
- Equalization of wet weather flows from separate sanitary sewers
- Equalization of combined storm and sanitary wastewater

This discussion is primarily concerned with equalization of dry weather flows. This procedure

*Extracted from "Flow Equalization" prepared for the EPA Technology Transfer Seminar Publication Series. Use the form at the rear of this newsletter for a copy of the complete publication.

provides a technique for achieving normal operation of a treatment plant under near ideal loading conditions. Its relatively low cost makes it attractive for upgrading an overloaded plant.

Although the use of influent sewers for equalization should not be ignored, the most positive and effective means to maximize the benefits possible with equalization is through the use of specially designed equalization basins. These basins should normally be located near the head end of the treatment works, preferably downstream of pretreatment facilities and mixing must be provided to keep the basins aerobic and prevent solids deposition.

It is sometimes desirable to locate the equalization basin at strategic locations within the collection system. This offers the added advantage of economically relieving trunk sewer overload during peak flow periods.[1] However, it does result in the need for a pumping facility and therefore is best located where a need for pumping already exists.

Equalization basins may be desired as either in-line or side-line units. In the in-line design all the flow passes through the equalization basin. This results in significant concentration and mass flow damping. In the side-line design only that amount of flow above the daily average is diverted through the equalization basin. This scheme minimizes pumping requirements at the expense of less effective concentration damping.

For new construction and for upgrading large plants, it is desirable to construct compartmentalized or multiple basins. This feature will allow the flexibility to dewater a portion of the facility for maintenance or equipment repair while still providing some flow equalization. Where a basin is designed for storage and equalization of wet weather flows, compartmentalized tanks will allow the utilization of a portion of the basin for dry weather flow equalization.

Single basin installations may be used for upgrading small plants, but must have the provision to be dewatered while maintaining complete treatment. This will require a bypass line around the basin to allow the downstream portion of the plant to operate unequalized when the flow equalization facility is out of service.

Impact On Primary Settling

The most beneficial impact on primary settling is the reduction of peak, overflow rates resulting in improved performance and a more uniform primary effluent quality. Flow equalization permits the sizing of new clarifiers based on equalized flow rates rather than peak rates. In an existing primary clarifier that is hydraulically overloaded during periods of peak diurnal flow, equalization can reduce the maximum overflow rate to an acceptable level. A constant influent feed rate also avoids hydraulic disruptions in the clarifier created by sudden flow changes, especially those caused by additional wastewater lift pumps suddenly coming on line.

LaGrega and Keenan[2] investigated the effect of flow equalization at the 1.8 mgd Newark, N.J., Wastewater Treatment Plant. An existing aeration tank was temporarily converted to an equalization basin. They compared the performance of primary settling under marginal operating conditions, with and without equalization. The results are show in Table 1.

It has been demonstrated[3,4] that preaeration can significantly improve primary settling. Roe[3] concluded that preaeration perflocculates suspended solids (SS) thereby improving their settling characteristics. Indications are that this benefit may be realized by aerated equalization basins. This benefit may be diminished when the equalized flow is centrifugally pumped to the primary clarifier due to the shearing of the floc.

Impact On Biological Treatment

Table - Effect of flow equalization on primary settling, Newark, N.Y.

Item	Normal flow	Equalized flow
Primary influent SS, mg/l	136.7	128
Primary effluent SS, mg/l	105.4	68
SS removal in primaries, percent	23	47

Note – Average flow slightly higher in unequalized portion of study.

As contrasted to primary treatment or other mainly physical processes where concentration damping is of minor benefit, biological treatment performance can benefit significantly from both concentration damping and flow smoothing. Concentration damping can protect biological processes from upset or failure from shock loading of toxic or treatment inhibiting side-line basins for biological treatment applications.

Improvement effluent quality due to stabilized mass loading of BOD on biological systems treating normal domestic wastes has not been adequately demonstrated to date. It is expected that the effect will be significant where diurnal fluctuations in organic mass loadings are extreme. This situation may arise at a wastewater treatment plant receiving a high-strength industrial flow of short duration. Damping of flow and mass loading will also improve aeration tank performance where aeration equipment is marginal or inadequate in satisfying peak diurnal-loading oxygen demands.[5]

The optimum pH for bacterial growth lies between 6.5 and 7.5. In-line flow equalization can provide an effective means for maintaining a stabilized pH within this range.

Flow smoothing can be expected to improve final settling even more so than primary settling. In the activated-sludge process, flow equalization has the added benefit of stabilizing the solids loading on the final clarifier. This has two ramifications:

- The mixed-liquor suspended solids (MLSS) concentration can be incareased thereby decreasing the food-to-mass ratio (F/M) and increasing the solids retention time (SRT). This may result in an increased level of nitrification, and a decrease in biological sludge production. It may also improve the performance of a system

operating at an excessively high daily peak F/M.
- Diurnal fluctuations in the sludge blanket level will be reduced. This reduces the potential for solids being drawn over the weir by the higher velocities in the zone of the effluent weirs.

Miscellaneous Benefits

In chemical coagulation and precipitation systems using iron aluminum salts, the quantity of chemical coagulant required as proportional to the mass of material to be precipitated. Damping of mass loadings with in-line equalization will improve chemical feed control and process reliability, and many reduce instrumentation complexity and costs.

Flow smoothing will reduce the surface area required and enhance the performance of tertiary filters. A constant feed rate will lead to more uniform solids loadings and filtration cycles.

The equalization basin provides an excellent point of return for recycled concentrated waste streams such as digester supernatent, sludge-dewatering filtrated, and polishing-filter backwash.

Some biochemical oxygen demand (BOD) reduction is likely to occur in an aerated equalization basin. A 10-to-20-percent reduction has been suggested for an in-line basin equalizing raw wastewater. However, the degree of reduction will depend upon the detention time in the basin, the aeration provided, wastewater temperature, and other factors. For an existing treatment plant, a simple series of oxygen uptake studies on a representative sample of wastewater can determine the BOD reduction that will occur.

Roe[3] observed that preaeration may improve the treatability of raw wastewater by creating a positive oxidation-reduction potential, thereby reducing the degree of oxidation required in subsequent stages of treatment.

Determination Of Equalization Requirements

The design of an equalization basin requires the evaluation and selections of a number of features as follows:

- In-line versus side-line basins
- Basin volume
- Degree of compartmentalization
- Type of construction-earthen, concrete, or steel
- Aeration and mixing equipment
- Pumping and control concept
- Location in treatment system

The design decisions must be based on the nature and extent of the treatment processes used, the benefits desired, and local site conditions and constraints.

It may not be necessary to equalize the entire influent flow where high flow or concentration variations can be attributed to one source, such as an industry. In these cases the desired benefits can be achieved by simply equalizing the industrial flow. This can be accomplished through construction of an equalization basin at the industrial site or through in-house industrial process modifications to effect and equalized wastewater discharge.

Determination Of Required Volume

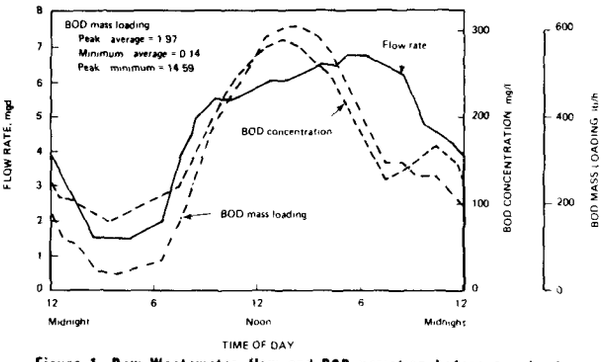


Figure 1. Raw Wastewater flow and BOD variation before equalization.

Two methods are available for computing equalization volume requirements. One procedure is based on the characteristic diurnal flow pattern. In this case, the function of the basin is to store flows in excess of the average daily flow and to discharge them at times when the flow is less than the average. The required volume can be determined graphically through the construction of a hydrograph. The second procedure is based upon the mass loading pattern of a particular constituent This method computes the volume required to dampen mass loading variations to within a preset acceptable range.[6,7]

Since the prime objective of flow equalization in wastewater treatment is to equalize flow, the determination of equalization volume should be based on the hydrograph. Once the volume has been determined for flow smoothing, the effect on concentration and mass load damping can be estimated. The required volumes for side-line and in-line basins will be identical. The hydrograph procedure is discussed below.

The first step in design involves the establishment of a diurnal flow pattern. Whenever possible, this should be based upon actual plant data. It is important to note that the diurnal pattern will vary from day to day, especially from weekday to weekend, and also from month to month. The pattern selected must yield a large enough basin design to effectively equalize any reasonable dry weather diurnal flow. Figure 1 depicts a typical diurnal flow pattern. The average flow rate is 4.3 mgd. For purpose of this example, the average flow is used as the desired flow rate out of the equalization basin. The diurnal peak and minimum flow rate for this example are 1.7 and 0.45 times the average, respectively.

The next step involves the actual construction of the hydrograph. The hydrograph for this example is shown on figure 2. The inflow mass diagram is plotted first. To do this, the hourly diurnal flows are converted to equivalent hourly volumes, and accumulated over the 24-hour day. A line is then drawn from the origin to the end point on the inflow-mass diagram. The slope of this line actually represents the average flow for the day.

Enough tank volume must be provided to accumulate flows above the equalized flow rate. This normally requires a volume equivalent to 10 to 20 percent of the average daily dry weather to the

average flow are shown as lines A and B on figure 2. The required volume is represented by the vertical distance between these two lines. In this illustration, the required volume for equalization is 740,000 gallons, which represents approximately 17 percent of the average daily flow.

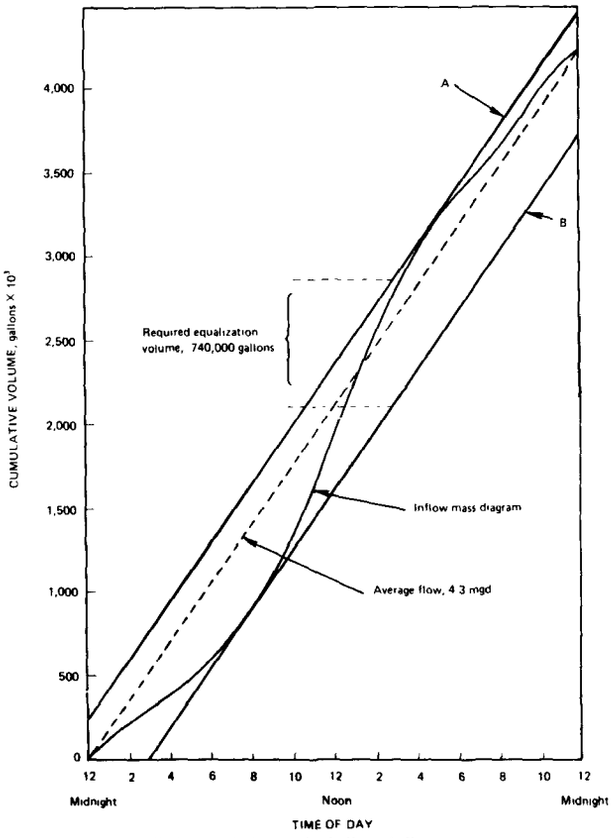


Figure 2. Hydrograph for typical diurnal flow.

The actual equalization-basin volume must be greater than that obtained with the hydrograph for several reasons, including

Continuous operation of aeration and mixing equipment will not allow complete drawdown.

- Volume must be provided to accommodate anticipated concentrated plant recycle streams.
- Some contingency should be provided for unforeseen changes in diurnal flow.

The final volume selected should include adequate consideration of the conditions listed above and will also depend on the basin geometry. For the example presented herein, a basin volume of approximately 1 million gallons is adequate.

References

[1] C. N. Click, "The Feasibility of Flow Smoothing Stations in Municipal Sewage System," USEPA Project No. 11010 FDI, Contract No. 14-12-935, Aug. 1972.

[2] M. D. LaGrega and J. D. Keenan, "Effects of Equalizing Sewage Flow," presented at 45th Annual Conference of the Water Pollution Control Federation, Atlanta, Ga., Oct. 1972.

[3] F. C. Roe, "Preaeration and Air Flocculation," Sewage Works J., 23, No. 2. 127-140, 1951.

[4] H. F. Seifel and E. R. Baumann, "Effect of Preaeration on the Primary Treatment of Sewage,: J. Water Pollut. Cont. Fed., 33 No. 4, 339-355, 1961.

[5] A. G. Boon and D. R. Burgess, "Effects of Diurnal Variations in Flow of Settled Sewage on the Performance of High Rate Activated-Sludge Plants," Water Pollution Cont., 493-522, 1972.

[6] P. R. Bradley and J. Y. Oldshue, "The Role of Mixing in Equalization," presented at 45th Annual Conference of the Water Pollution Control Federation, Atlanta, Ga., Oct. 1972.

[7] A. T. Wallace, "Analysis of Equalization Basins," J. Sanit. Eng. Div., ASCE, SA6, 1161-1171, 1968.

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 your EPA Regional Technology Transfer Committee Chairman from the list below:

REGION	CHAIRMAN	ADDRESS
I	Lester Sutton	Environmental Protection Agency John F. Kennedy Federal Building Room 2304 Boston, Massachusetts 02203 617 223-2226 [Maine, N.H., Vt., Mass., R.I., Conn.]
II	Robert Olson	Environmental Protection Agency 26 Federal Plaza New York, New York 10017 212 264-1867 [N.Y., N.J., P.R., V.I.]
III	Albert Montague	Environmental Protection Agency 6th & Walnut Streets Philadelphia, Pennsylvania 19106 215 597-9856 [Pa., W Va., Md., Del., D.C., Va.]
IV	Asa B. Foster, Jr.	Environmental Protection Agency Suite 300 1421 Peachtree Street, N.E. Atlanta, Georgia 30309 404 526-3454 [N.C., S.C., Ky., Tenn., Ga., Ala., Miss., Fla.]
V	Clifford Risley	Environmental Protection Agency 1 N. Wacker Drive Chicago, Illinois 60606 312 353-5756 [Mich., Wis., Minn., Ill., Ind., Ohio]
VI	Mildred Smith	Environmental Protection Agency 1600 Patterson Street, Suite 1100 Dallas, Texas 75201 214 749-1461 [Texas, Okla., Ark., La., N. Mex.]
VII	John Coakley	Environmental Protection Agency 1735 Baltimore Avenue Kansas City, Missouri 64108 816 374-5971 [Kansas, Nebr., Iowa, Mo.]
VIII	Russell Fitch	Environmental Protection Agency 1860 Lincoln Street Denver, Colorado 80203 303 837-3849—837-3691 [Colo., Mont., Wyo., Utah, N D., S.D.]
IX	Frank Covington	Environmental Protection Agency 100 California Street San Francisco, Calif. 94111 415 556-0218 [Calif., Ariz., Nev., Hawaii]
X	John Osborn	Environmental Protection Agency 1200 6th Avenue Seattle, Washington 98101 206 442-1296 [Wash., Ore., Idaho, Alaska]

REQUEST FOR TECHNOLOGY TRANSFER MATERIAL

Please send me the following publications at no charge. (Check appropriate boxes) The publications Listed on this form are the only ones available through the Office of Technology Transfer.

PROCESS DESIGN MANUALS

- ☐ Phosphorus Removal 1001
- ☐ Carbon Adsorption 1002
- ☐ Suspended Solids Removal 1003
- ☐ Upgrading Existing Wastewater Treatment Plants 1004
- ☐ Sulfide Control in Sanitary Sewerage Systems 1005
- * ☐ Sludge Treatment and Disposal 1006

TECHNICAL CAPSULE REPORTS

- ☐ Recycling Zinc in Viscose Rayon Plants 2001
- ☐ Color Removal from Kraft Pulping Effluent by Lime Addition 2002
- ☐ Pollution Abatement in a Copper Wire Mill 2003
- ☐ First Interim Report on EPA Alkali SO_2 Scrubbing Test Facility 2004
- ☐ Dry Caustic Peeling of Peaches 2005
- * ☐ Pollution Abatement in a Brewing Facility 2006

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

MUNICIPAL SEMINAR PUBLICATIONS

- ☐ Upgrading Lagoons 4001
- ☐ Physical-Chemical Treatment 4002
- ☐ Oxygen Activated Sludge 4003
- ☐ Nitrification/Denitrification 4004
- ☐ Upgrading Existing Wastewater Treatment Facilities-Case Histories 4005
- * ☐ Flow Equalization 4006
- * ☐ Wastewater Filtration 4007
- * ☐ Physical-Chemical Nitrogen Removal 4008

BROCHURES

- ☐ Physical-Chemical Treatment 5001
- ☐ Phosphorus Removal 5002
- ☐ Upgrading Existing Wastewater Treatment Plants 5003
- ☐ Carbon Adsorption 5004
- ☐ Oxygen Aeration 5005
- ☐ Nitrogen Control 5006
- ☐ Seattle, Washington METRO 5007
- ☐ Wastewater Purification at Lake Tahoe 5008
- ☐ Indian Creek Reservoir 5009
- ☐ Richardson, Texas 5010

HANDBOOKS

- ☐ Analytical Quality Control in Water and Wastewater Laboratories 6001
- ☐ Monitoring Industrial Wastewater 6002

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* Publications listed for first time

For the following audio-visual material, please contact your Regional Technology Transfer Chairman. (See listing)

MOTION PICTURES (16mm sound)

Richardson Texas Project – Title:
"Somebody around here must be doing something good." (15 min.)

Phosphorus Removal (5 min.)

Water Quality Management, Alameda Creek, Calif. – Title:
"The Water Plan" (28½ min.)

The Seattle METRO Story (28 min.)

VIDEOTAPES

Carbon Adsorption (40 min.)

Upgrading Activated Sludge Treatment Plants (40 min.)

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TECHNOLOGY TRANSFER

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U.S. ENVIRONMENTAL PROTECTION AGENCY OCTOBER 1, 1973

WPCF CONFERENCE

For the third consecutive year, EPA Technology Transfer is participating in the annual Water Pollution Control Federation Conference, with this year's WPCF meeting—the 46th annual—being held in Cleveland, Ohio, September 30-October 5, 1973.

The theme of the newly designed and constructed exhibit being displayed at the WPCF Conference is the Technology Transfer Seminar Program. As you may be aware, more than 30 seminars have been conducted throughout the country by Technology Transfer to present detailed information on the latest pollution control technologies and practices. Subject areas of the Municipal Seminars for wastewater treatment facilities are oriented to the specific needs of the geographical region in which they are held. The Industrial Seminars are aimed at making the small manufacturer aware of the alternative proven technologies available to him by addressing the air, water, and solids pollution problems of that industry.

Technology Transfer has also chosen this year's WPCF Conference to introduce the first five municipal wastewater treatment publications in its new series of Seminar Publications. These five publications are explained in some detail further on in this newsletter and will be available free of charge at the exhibit. The first five industrial pollution control publications in this series will be displayed at the exhibit and may be ordered there.

Host region for this year's conference will be EPA's Midwest Region V. Francis T. Mayo, the Regional Administrator, will be on hand at the opening of the Conference, which annually attracts thousands of the nation's top pollution experts.

Region V will have a special exhibit in the convention area and the Region V film "Get Together" will be included in a special WPCF film program.

Mr. Mayo has been administrator for Region V since early 1970. He's a Commissioner to the Great Lakes Basin Commission and serves as Chairman of the U.S. Section of the Great Lakes Water Quality Board, which advises the International Joint Commission on Great Lakes water quality problems.

Francis T. Mayo
Region V
Administrator

Well known among environmentalists, business and community leaders in the Midwest, Mayo has one of the toughest jobs in EPA—he contends with a highly urban and industrialized region where 44 million people and one quarter of the region's manufacturing is located. The Region has an endless diversity of sophisticated industrial air and water pollution problems combined with agricultural problems within a vacation and water recreational area.

Mr. Mayo's Technology Transfer Committee, therefore, must continually deal with a wide range of issues and has in past months conducted seminars covering technical areas on meatpacking, dairy processing, upgrading existing wastewater treatment plants, nitrogen control, phosphorus removal, infiltration studies and combined sewers. Planned for the future are seminars on sludge handling and disposal and metal finishing. Also in the works are films for small and medium industrial dischargers looking for new ways of controlling pollution.

SECOND TECHNOLOGY TRANSFER INDUSTRIAL SEMINAR FOR MEAT PACKING INDUSTRY HELD IN CHICAGO, ILLINOIS

The Office of Technology Transfer held its second seminar for about 100 engineers and managers from the Meat Packing Industry entitled,

"Upgrading Meat Packing Facilities to Reduce Pollution," in Chicago, Illinois, on June 12 and 13, 1973.

The program featured addresses on Effective Government-Industry Relations by Francis T. Mayo, Administrator of EPA Region V, and Donald S. MacKenzie, of the American Meat Institute. The requirements of the new water pollution control legislation were presented by John Kirkwood of the Regional Office. William M. Sonnett of the Office of Permit Programs, Washington, D.C., gave a presentation on the National Discharge Elimination Program.

Two technical sessions were presented. The first session on "In-Plant Modifications and Pretreatment" was by A. J. Steffan of Purdue University. The second session on Waste Treatment systems was given by Jim and Paula Wells of Bell, Galyardt & Wells.

A special evening panel session was held on Odor Control. Donald Dencker of Oscar Mayer, Kenneth Ries of Armour, and William Prokop of the National Renderer's Association joined Al Steffan and Jim Wells to form the panel.

The final general session included a presentation on "Optimum Strategies for Financing Pollution Control Investments" by Charles Marshall of J. A. Cummins and Associates, and a presentation on the EPA Industrial Demonstration Grant Program by Jack Witherow of the National Environmental Research Center in Corvallis, Oregon. Also Larry Cherry of the Small Business Administration presented information on SBA programs which are applicable to meat packers.

POLLUTION CONTROL SEMINAR FOR THE DAIRY INDUSTRY

Technology Transfer held its second industrial seminar for the Dairy Industry, entitled "Upgrading Dairy Production Facilities to Reduce Pollution," in Philadelphia, on August 21 and 22, 1973.

The program featured a welcome address by Daniel J. Snyder, III, Regional EPA Administrator and a special presentation by Fred J. Greiner, Chairman of the Dairy Industry Committee, speaking on Dairy Industry Environmental Responsibilities.

The program included presentations on EPA enforcement policy and the National Discharge Elimination Program.

Three technical sessions were held covering in-plant management, waste treatment, and whey disposal and recovery. The in-plant session, conducted by Dr. W. James Harper, of the Ohio State University, covering dairy waste characterization, in-plant reduction of water and wastes, and costs of in-plant control.

The session on waste treatment, presented by Kenneth Watson of Kraftco Corporation, George Muck of Dean Foods, Dr. William Boyle and Dr. L. B. Polkowski of Polkowski, Boyle and Associates, and Paul F. Hickman of Hood and Rich Architects & Engineers, covered treatment alternatives available for discharge of wastes to municipal treatment plants and to waterways. The discussion included the relative advantages of joint treatment of dairy wastes in municipal wastewater treatment plants, waste treatment alternatives, and case studies of actual pollution abatement efforts by dairy production facilities.

The session on whey consisted of a panel discussion of the recovery, utilization, and disposal of whey. The discussion covered current practice and new technology applicable to the utilization of whey.

UPDATING OF PROCESS DESIGN MANUALS

Revisions to the four original Technology Transfer Process Design Manuals (Suspended Solids Removal, Carbon Adsorption, Phosphorus Removal, and Upgrading Existing Wastewater Treatment Plants) are approaching completion and will be available in the very near future.

The purpose of revising these manuals—originally issued in October 1971—was to incorporate information on newly developed and demonstrated techniques and to include any subsequent experience gained and data produced on those methods covered in the initial edition of the manuals.

For those individuals who have the original manuals and have not yet requested the manual revisions, it is essential this be done as soon as possible. This can be accomplished by either forwarding the request card contained in the back of each manual, or by sending a brief letter to Technology Transfer, U.S. Environmental Protection Agency, Washington, D.C. 20460.

The final general session included a presentation by James Cummins of J. A. Cummins and Associates, an industrial management consultant, on the optimization of financial strategy for pollution control investments. The discussion covered tax advantages, depreciation of equipment, government and private sources of financing available, and the economics of joint treatment with a municipality versus privately financed treatment facilities.

TECHNICAL CAPSULE REPORT ON DRY CAUSTIC PEELING OF PEACHES NOW AVAILABLE

A technical capsule report covering an EPA Demonstration Project with the DelMonte Corporation for the dry caustic peeling of peaches is now available.

Peeling is the largest single source of waste from fruit processing. In conventional caustic peeling, the peel is pre-softened by contact with

SULFIDE CONTROL MANUAL IN PRINT

The Technology Transfer Process Design Manual for Sulfide Control in Sanitary Sewerage Systems, prepared by Pomeroy, Johnston and Bailey of Pasadena, California, is currently being printed and will soon be available for distribution. This Manual includes information for all feasible alternative designs that can be used to control sulfides and minimize their effects in both new and existing sewerage systems.

Specific topics covered include: Characteristics and Properties of Hydrogen Sulfide; Occurrence and Effects of Sulfide in Sewers; Investigation in Existing Systems; Control of Sulfide in Existing Systems; and Design of Sewer Systems to Prevent Sulfide Problems. Case histories, examples, and cost estimates are presented to substantiate the "how-to" approach of this manual.

Individuals interested in obtaining, at no charge, a copy of the Sulfide Control Manual should fill out the appropriate form in the back of this publication and forward it to Technology Transfer, U.S. Environmental Protection Agency, Washington, D.C. 20460.

"HANDBOOK FOR MONITORING INDUSTRIAL WASTEWATER" NOW AVAILABLE

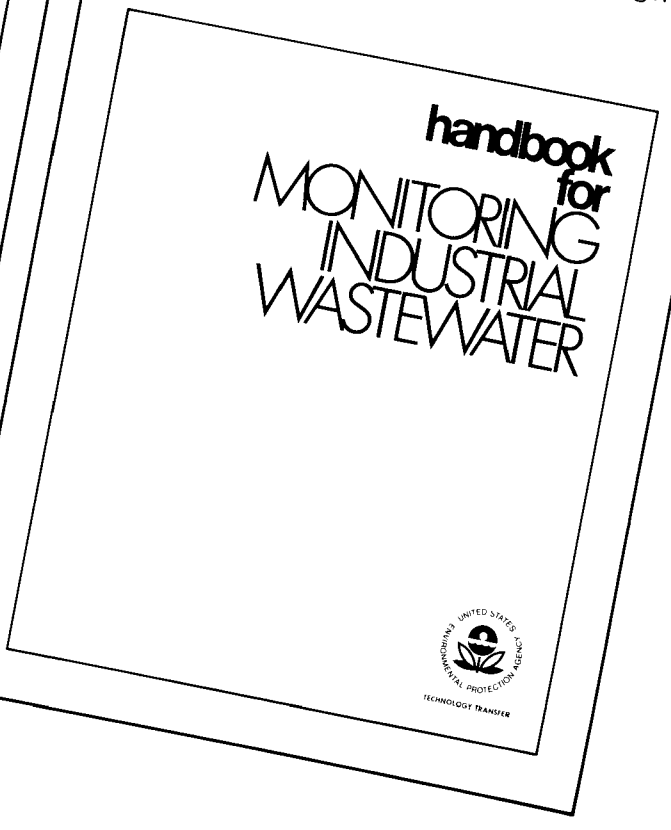
The first of the EPA Technology Transfer Industrial manuals is now available. The "Handbook for Monitoring Industrial Wastewater" provides technical information for manufacturers establishing a wastewater monitoring program. As is the case with all Technology Transfer publications the Handbook is offered as helpful guidance only and is not regulatory.

Major chapters in the Handbook are:

- Program Planning
- Parameters to be Measured
- Analytical Considerations
- Sampling
- Flow Measurement
- Data Analysis
- Automatic Monitoring
- The Continuing Program
- Special Considerations for Municipal Systems
- Training of Technicians
- Safety

The manual is written with basic information for managers in the beginning of each chapter with the more detailed technical information in the latter sections. Special emphasis is placed on minimizing the costs of monitoring and avoiding common pitfalls.

For your copy of this handbook mail the form on the last page of this newsletter to Technology Transfer, U.S. Environmental Protection Agency, Washington, D.C. 20460.



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• "Oxygen Activated Sludge Wastewater Treatment Systems—Design Criteria and Operating Experience" by Union Carbide Corporation and Metcalf and Eddy, Engineers. This publication includes sections on Unox-system description, operating data and experience, process design, process safety, economic considerations, and ...pecifications for final settling tanks and oxy...ion tanks.

Where To Get Further Information

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REGION	CHAIRMAN	ADDRESS
I	Lester Sutton	Environmental Protection Agency John F. Kennedy Federal Building Room 2304 Boston, Massachusetts 02203 617 223-2226 (Maine, N.H., Vt., Mass., R.I., Conn.)
II	Rocco Ricci	Environmental Protection Agency 26 Federal Plaza New York, New York 10017 212 264-2513 (N.Y., N.J., P.R., V.I.)
III	Kenneth Suter	Environmental Protection Agency 6th & Walnut Streets Philadelphia, Pennsylvania 19106 215 597-9268 (Pa., W.Va., Md., Del., D.C., Va.)
IV	Asa B. Foster, Jr.	Environmental Protection Agency Suite 300 1421 Peachtree Street, N.E. Atlanta, Georgia 30309 404 526-3454 (N.C., S.C., Ky., Tenn., Ga., Ala., Miss., Fla.)
V	Clifford Risley	Environmental Protection Agency 1 N. Wacker Drive Chicago, Illinois 60606 312 353-5756 (Mich., Wis., Minn., Ill., Ind., Ohio)
VI	Jocelyn G. Kempe	Environmental Protection Agency 1600 Patterson Street, Suite 1100 Dallas, Texas 75201 214 749-1238 (Texas, Okla., Ark., La., N.Mex.)
VII	Lewis A. Young	Environmental Protection Agency 1735 Baltimore Avenue Kansas City, Missouri 64108 816 374-2725 (Kansas, Nebr., Iowa., Mo.)
VIII	Russell Fitch	Environmental Protection Agency 1860 Lincoln Street Denver, Colorado 80203 303 837-3849—837-3691 (Colo., Mont., Wyo., Utah, N.D., S.D.)
IX	Frank Covington	Environmental Protection Agency 100 California Street San Francisco, Calif. 94111 415 556-0218 (Calif., Ariz., Nev., Hawaii)
X	John Osborn	Environmental Protection Agency 1200 6th Avenue Seattle, Washington 98101 206 442-1296 (Wash., Ore., Idaho, Alaska)

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North Carolina; Livermore, California; New York, N.Y. and upgrading an existing trickling filter plant by the addition of activated sludge ahead of the filters.

• "Physical-Chemical Wastewater Treatment Plant Design" by CH_2M/Hill. This publication includes sections on preliminary data collection, selection of coagulants, carbon adsorption, process design, and physical-chemical treatment of small waste flows. Also included are design project descriptions on Niagara Falls, N.Y. and Fitchburg, Massachusetts by Camp, Dresser & McKee, Inc.

• "Upgrading Lagoons" by Brown and Caldwell, Consulting Engineers. This publication includes sections on lagoons in waste treatment, techniques for upgrading lagoons and examples of upgrading ponds at Sunnyvale, California; Los Banos, California; and Stockton, California.

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REQUESTS FOR TECHNOLOGY TRANSFER MATERIAL

Please send me the following publications at no charge. (Check appropriate boxes)

PROCESS DESIGN MANUALS

- ☐ Phosphorus Removal
- ☐ Carbon Adsorption
- ☐ Suspended Solids Removal
- ☐ Upgrading Existing Wastewater Treatment Plants
- ☐ Sulfide Control in Sanitary Sewerage Systems

TECHNICAL CAPSULE REPORTS

- ☐ Recycling Zinc in Viscose Rayon Plants
- ☐ Color Removal from Kraft Pulping Effluent by Lime Addition
- ☐ Pollution Abatement in a Copper Wire Mill
- ☐ First Interim Report on EPA Alkali SO_2 Scrubbing Test Facility
- ☐ Dry Caustic Peeling of Peaches

INDUSTRIAL SEMINAR PUBLICATIONS

- ☐ Upgrading Poultry Processing Facilities to Reduce Pollution (3 Vols.)
- ☐ Upgrading Metal Finishing Facilities to Reduce Pollution (2 Vols.)

MUNICIPAL SEMINAR PUBLICATIONS

- ☐ Upgrading Lagoons
- ☐ Physical-Chemical Treatment
- ☐ Oxygen Activated Sludge
- ☐ Nitrification/Denitrification
- ☐ Upgrading Existing Wastewater Treatment Facilities—Case Histories

BROCHURES

- ☐ Physical-Chemical Treatment
- ☐ Phosphorus Removal
- ☐ Upgrading Existing Wastewater Treatment Plants
- ☐ Carbon Adsorption
- ☐ Oxygen Aeration
- ☐ Nitrogen Control
- ☐ Seattle, Washington METRO
- ☐ Wastewater Purification at Lake Tahoe
- ☐ Indian Creek Reservoir
- ☐ Richardson, Texas

HANDBOOKS

- ☐ Analytical Quality Control in Water and Wastewater Laboratories
- ☐ Monitoring Industrial Wastewater

Please contact me regarding the loan of the following audio/visual material. (Check appropriate boxes)

MOTION PICTURES (16mm sound)

- ☐ Richardson, Texas, Project—Title "Somebody around here must be doing something good." (15 min.)
- ☐ Phosphorus Removal (5 min.)
- ☐ Water Quality Management, Alameda Creek, Calif.—Title "The Water Plan" (28½ min.)

VIDEOTAPES

- ☐ Carbon Adsorption (40 min.)
- ☐ Upgrading Activated Sludge Treatment Plants (40 min.)

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Note: Tear this sheet out and forward to Technology Transfer, U.S. Environmental Protection Agency, Washington, D.C. 20460

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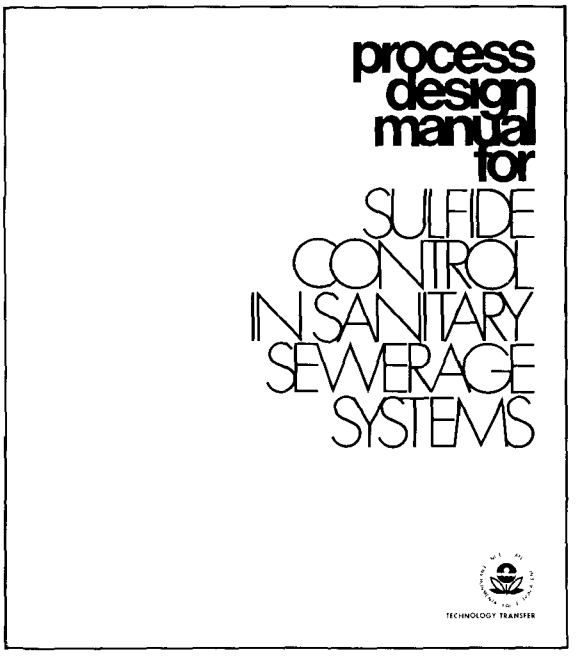

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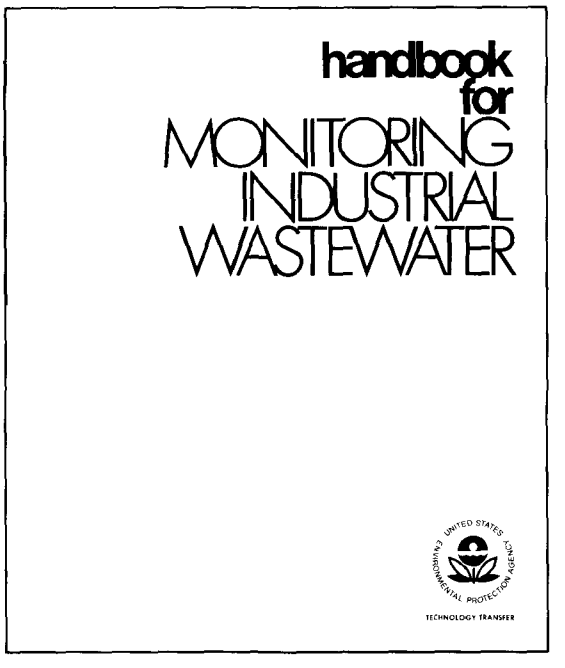

dilute sodium hydroxide and removed from the peach by high pressure water sprays. Dry caustic peeling uses mechanical contact to remove the softened peel, with only a small final water rinse. Dry caustic peeling was commercially proven for potato processing, but softer fruit such as peaches required additional development.

The project demonstrated the reduction of water usage from 850 gallons per ton of peaches to 90 gallons per ton. The peel was recovered as a pumpable slurry. Total organic and suspended solids loading in the final wastewater was reduced by 60 percent. Peach quality was equal to that of conventionally peeled peaches.

For your copy of this capsule report which includes cost and performance data, use the ordering blank at the end of this newsletter.

WORK UNDERWAY ON INDUSTRIAL POLLUTION CONTROL MANUALS

The Office of Technology Transfer has initiated work on the preparation of two manuals for the control of air, water and solid waste pollution for the Pulp and Paper and the Power Generation Industries. The manuals will contain design information on available technology presented in a form that can be used by industry engineers and managers, and consultants in the designing and upgrading and designing of facilities to control pollution.

The pulp and paper manual will cover design considerations for in-plant control techniques and waste treatment technology for wood preparation, kraft, soda, and acid sulfite pulping operations, de-inking, paper manufacturing, waste paperboard production and building products manufacturing. Ekono Consulting Engineers, Seattle, Washington, has been selected as the contractor for the preparation of this manual.

The power manual will cover design considerations for in-plant control techniques and treatment technology for the control of air emissions, chemical wastewater discharges, thermal pollution control, solid waste separation, utilization and disposal, and air, water and solid waste monitoring for fossil full-fired generating stations. Radian Corporation of Austin, Texas, has been selected as the contractor for the preparation of this manual.

Both the pulp and paper, and the power manuals should be available for distribution by June, 1974.

NEW TECHNOLOGY TRANSFER MOTION PICTURE AVAILABLE

Technology Transfer now has available for loan a third motion picture depicting the successful implementation of new technology. Entitled "The Water Plan," this 28-minute 16mm film was produced for Technology Transfer by Production House, Inc., of San Francisco, California.

The film presents the development and current implementation of the water quality management plan for the Alameda Creek Watershed in suburban San Francisco. This particular plan involves: a) upgrading two wastewater treatment facilities to "advanced waste treatment", including nutrient removal, producing an effluent suitable for reuse; b) conveyance of the reclaimed wastewater to a reservoir to be constructed; c) development of associated recreational facilities at the reservoir; and d) potential recycling of reclaimed wastewater. The cooperative efforts of the Alameda County Flood Control and Water Conservation District, the City of Livermore, the City of Pleasanton, and the Valley Community Services District played a major role in development of the plan.

Requests for loan of this, and other Technology Transfer films, can be made by forwarding the form in the back of this newsletter.

MUNICIPAL DESIGN SEMINARS

The Technology Transfer Program has conducted one additional municipal design seminar since June, 1973, bringing the total number conducted since the program was conceived to 22. The most recent seminar presented was in Shreveport, La., August 21-23.

The Shreveport Seminar included sessions on physical-chemical treatment, upgrading existing wastewater treatment facilities, and nitrogen control. Feature presentations were given by Gordon Culp, Culp, Wesner & Culp/Clean Water Consultants; Clair Sawyer, Consulting Engineer; and David Walrath, Hazen and Sawyer. EPA personnel participating in the seminar were Jesse Cohen, Ed Barth, and John Smith from the National Environmental Research Center in Cincinnati, Ohio.

MUNICIPAL SEMINAR PUBLICATIONS

The first five in a series of seminar publications are being featured and distributed at the Technology Transfer Exhibit this week during the WPCF Conference. These publications include the basic information included in the handout materials used at the Technology Transfer municipal design seminars. If desired, these publications may also be obtained by using the order form in the back of this newsletter.

The set consists of the following publications:

- "Nitrification & Denitrification Facilities Wastewater Treatment" by Metcalf & Eddy, Engineers. This publication includes sections on the factors affecting nitrification kinetics, design critera of nitrification systems, and denitrification by suspended growth systems.
- "Upgrading Existing Wastewater Treatment Plants—Case Histories" by Hazen and Sawyer. This publication includes sections on upgrading through biological process modifications, solids retention time, and case histories on Greensboro,

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