clean water

REPORT TO CONGRESS 1975-76

U. S. ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D. C. 20460

Environmental Protection Agency
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Chicago, Illinois 60604

Dear Mr. President
Dear Mr. Speaker:

I am pleased to transmit to the Congress, as required by section 516(a) of the Federal Water Pollution Control Act, the third of a series of annual reports covering measures taken to implement the objectives of the Act. This is a consolidated report covering calendar year 1974 and 1975,

Highlights of the report include:

- By December 31, 1975, EPA had obligated over $8.2 billion dollars for municipal wastewater treatment works construction. Estimated needs, however, greatly exceed these amounts, and a strong Federal-State effort will be needed to accelerate obligations of the remaining authorized funds.
- The issuance of the first round of National Pollutant Discharge Elimination System permits was virtually completed for major sources—over 45,000 permits were issued by the end of December, 1975. The major focus in the permits area must now shift to assuring compliance with the permit conditions, if the potential of the program is to be realized.
- State planning and management agencies have completed a majority of the scheduled waste load analyses: over 1700 segment analyses were reported complete by June 30, 1975. In addition, the areawide waste treatment management planning program under section 208 was initiated during the year. Timely completion of plans and the use of plan outputs for related program management actions must now be emphasized.
- The States have assumed increasing responsibilities in the national water quality program. By the close of 1975, 27 States were participating in the National Pollutant Discharge Elimination System, and the number continues to rise. The State role in construction grants administration was also expanded. Other important areas of Federal-State cooperation include the national compliance monitoring system, water quality reporting, the State program under section 106, involvement in wastewater treatment operation and maintenance inspections and evaluations, and attention to the training and development of waste water treatment plant operation and maintenance personnel. Limitations on State resources will be a continuing restraint in this aspect of the program.
- Water quality studies were continued, addressing problems such as lake eutrophication and the potential impact of revised water quality criteria being prepared by the Agency. Work has proceeded on the Water Quality Inventory Report, to be completed in early 1976.
- An approach to State and local management of nonpoint sources of pollution was developed, to be carried out as an important part of the State and areawide water quality management process, under EPA guidance. Various problems are foreseen, but these should not deter proceeding with a program in localities where it is needed.
- Methods to reduce the total flow of sewage were reviewed, and several promising devices and techniques were analysed.
- Research studies investigated health effects, ecological processes and effects, municipal, industrial and nonpoint source pollution control, and other areas of program or data management importance.

The water quality program under the 1972 Federal Act remains a relatively new effort. Although problems will continue to be encountered in many areas of the program, the significant accomplishments to date are highly encouraging.

Sincerely,

Russell E. Train

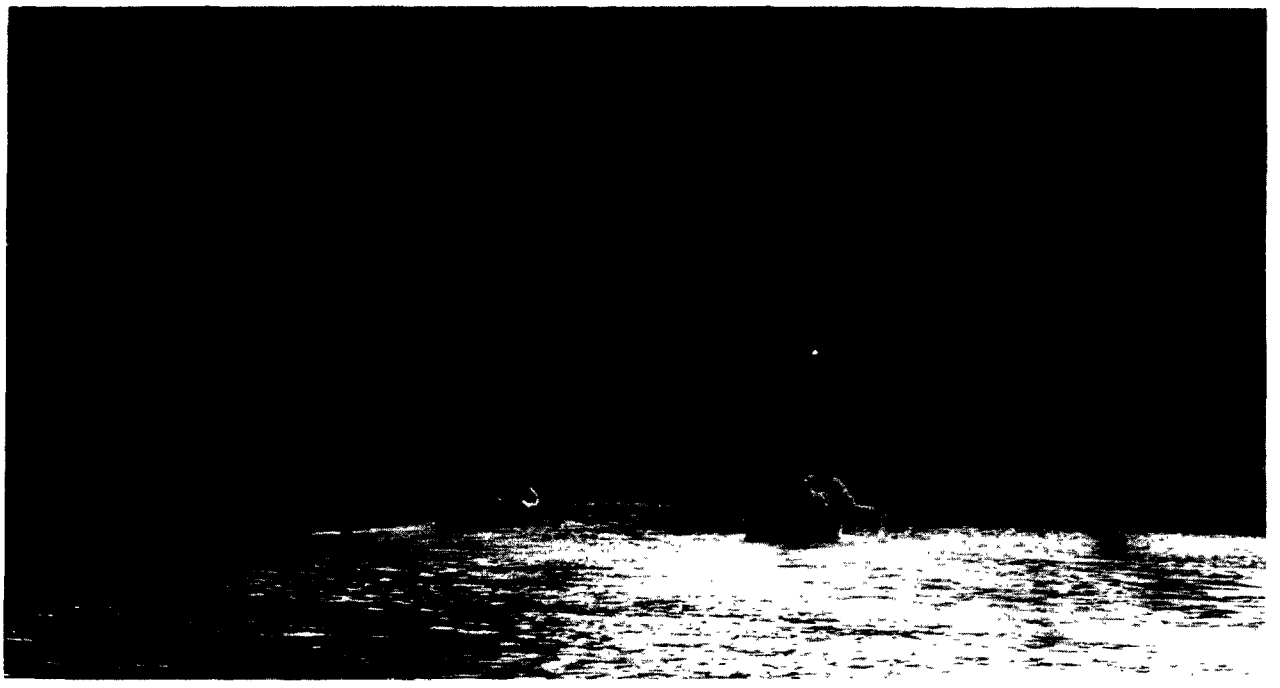
RUSSELL E. TRAIN

Introduction

Clean water, the title of this Report, is the goal of the national water quality program. More than three years have passed since the Federal Water Pollution Control Act ("the Act") was amended on October 18, 1972, to add major new programs directed toward this purpose. It has been a time for learning, deciding, and acting—learning more about current water quality and its protection; deciding the basic questions inherent in the development of major new programs; and acting to carry out the important initiatives of the Act.

EPA has wrestled with countless problems during this time. Nor is this a solitary undertaking. The Act reaches into every corner of the land. No individual who uses water can fail to be affected, directly or indirectly, by the pervasive scope of the 1972 law.

This report summarizes and highlights EPA's actions during 1974 and 1975. Progress in many areas is noted; where there are problems, these are also described. Together, the photographs, charts, and narrative attempt to present a comprehensive overview of EPA's myriad activities performed to implement the Act and move toward its objective.



Protecting existing high quality waters is an important policy in the Nation's water quality program. *(Canoeing on the Wisconsin River.)*

Water Quality—Monitoring Standards and Goals

Knowledge of existing water quality is expanding, although the informational base remains imperfect. Enough is known to recognize that a great deal of water quality improvement remains to be accomplished.

Water quality standards define specific water uses and criteria for individual waterways. They are an important part of the Federal/State regulatory scheme for pollution abatement.

A further goal—restoration, preservation and maintenance of water quality—is also a major component of the system. Its purpose is to assure that existing water quality will not deteriorate in contravention of the Act.

WATER QUALITY MONITORING—THE PRESENT PICTURE

Collection and analysis of current water quality data is the first step in developing national water quality requirements, goals and expectations. During 1974 and 1975, EPA's attention was directed both to reviewing water quality data and to developing new information.

Reviewing Current Information

Studies of water quality are conducted throughout the country by EPA, other Federal agencies, and State and local organizations. During 1975 the States for the first time prepared and submitted to EPA their own reports on water quality and related programs. These reports, along with a national summary and analysis by EPA, have been transmitted to Congress as called for under Section 305(b). In total, the report provides the most comprehensive nationwide review to date of:

Current water quality and recent trends
Current and projected uses of the water
Costs of meeting water quality objectives
Nonpoint source pollution problems

The States generally confirm the findings of the *1974 National Water Quality Inventory* report to Congress that, despite recent improvements in the levels of pollutants which had received widespread control efforts, such as bacteria and oxygen-demanding organic loads, significant problems from these pollutants still exist in many areas, especially near population centers.

Furthermore, several States reported worsening trends for nitrogen and phosphorus, the nutrients most often blamed for eutrophication. These trends were also noted in the 1974 report. Significant problems were also caused by toxic substances such as dissolved metals, industrial chemicals, pesticides, and other harmful compounds.

The 1975 305(b) report also contains two sections describing special analyses done by EPA:

The National Water Quality Surveillance System (NWQSS)—The NWQSS, established under Section 104(a), consists of 188 monitoring stations located upstream and downstream of selected areas across the country (Figure I-1). The areas were chosen to reflect a cross-section of the different types of streams and land use characteristics found in the United States. The analysis of the first year's data focused on determining the relationships between water quality parameters and the differing uses of the land. It was found that bacteria and nutrient levels were strongly related to municipal/industrial activity and, to a lesser degree, to agri-

cultural activity. Oxygen-demanding loads and total solids loads were not as strongly related to levels of land use activity.

The National Eutrophication Survey—EPA's reseach laboratories in Corvallis, Oregon and Las Vegas, Nevada have been studying lakes throughout the country to determine the extent of the nation's eutrophication problem. The survey found that phosphorus is the element which usually needs to be controlled to slow the rate of eutrophication. Of the 298 lakes surveyed in 22 States east of the Mississippi, 73 percent have phosphorus concentrations high enough that they would be expected to exhibit eutrophication symptoms.

Developing New Information

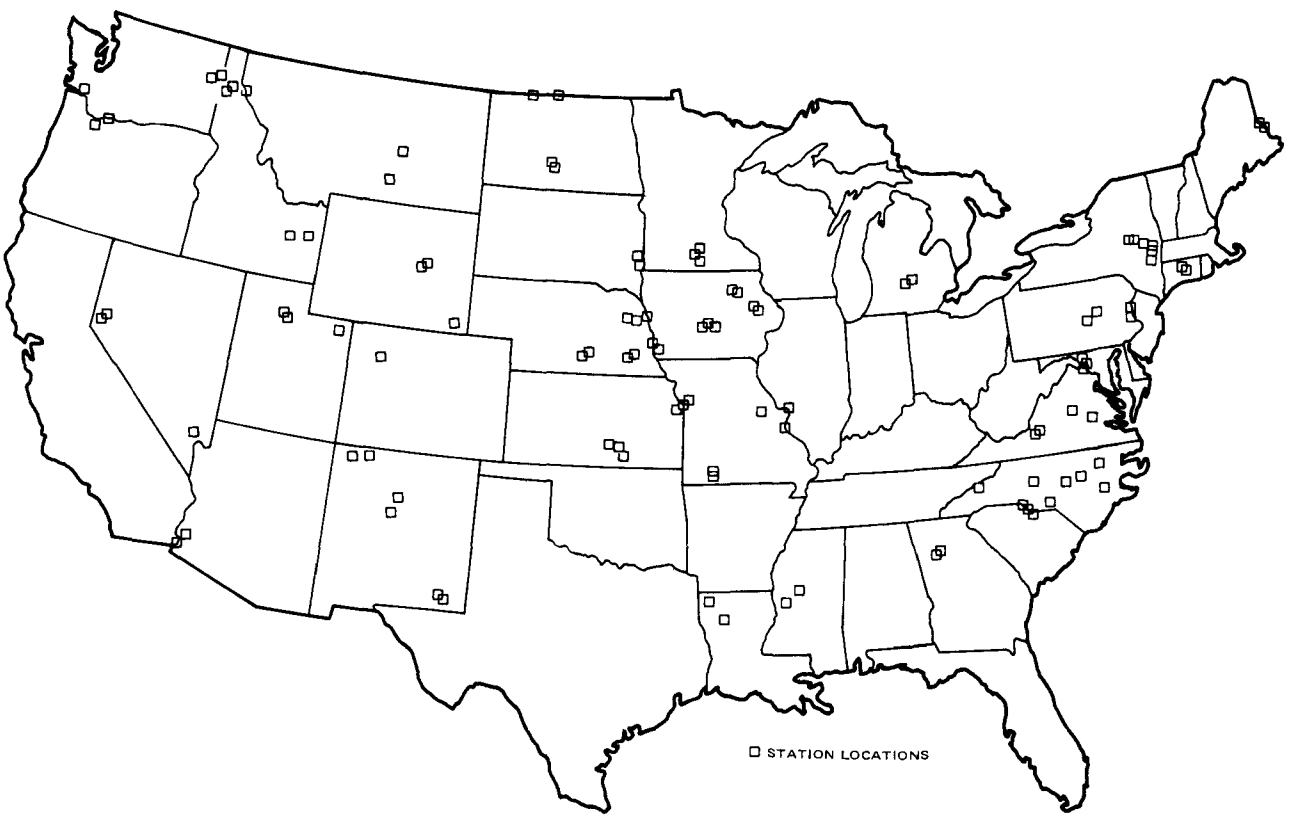
Additional water quality information is needed for many aspects of the national water quality program. Data can indicate areas for future priority attention and reveal the appearance of new problems, as well as showing the consequences of past efforts.

Several programs are currently under way. The National Eutrophication Survey is completing its coverage of the nation's lakes and should have its final results available by the end of 1976. State monitoring programs are being improved to provide greater capability for studying all areas within a State. For example:

- In FY 76, the majority of states were operating primary monitoring networks. This is a vast improvement over FY 75.
- Intensive surveys have been improved greatly in FY 76. However, many states still need to expand and intensify their efforts in this area.
- Approximately one half of the states operate programs specifically designed to monitor lakes and reservoirs.

Figure 1-1.

NATIONAL WATER QUALITY SURVEILANCE SYSTEM



- Most of the states have NPDES authority and therefore operate compliance monitoring programs.
- Quality assurance programs have shown much improvement over FY 75. Most of the states have now developed quality assurance programs and are in the process of implementing these plans.
- Approximately one half of the states are now operating some type of biological monitoring program.

For the *1976 National Water Quality Inventory* report, the States will be focussing on an analysis of the projected effects of the Act's effluent limitations on water quality and water uses. The NWQSS analysis will attempt to determine the relative magnitude of pollutant loadings from point source discharges and from nonpoint sources for different types of pollutants.

The National Commission on Water Quality. formed under section 315 of the Act to "make a full and complete investigation and study of all of the technological aspects of achieving, and all aspects of the total economic, social, and environmental effects of achieving or not achieving, the effluent limitations and goals set forth for 1983" has completed its regional assessment studies and its staff draft report. The final report is expected early in 1976.

WATER QUALITY STANDARDS—THE CURRENT RULE

Water quality standards, section 303, establish and define water quality requirements for specific waters. Through standards, all waters are classified in terms of their uses, such as swimming, aquatic life or drinking water supply. Standards also set the specific criteria needed to protect the uses.

Standards are a two-pronged weapon in the pollution fight. They both mandate current abatement activities and set goals for longer-range planning. Regarding abatement, individual sources must meet existing standards, even where this results in tougher discharge limitations than those demanded by the Act's technology-based requirements. As to planning, standards underlie the management actions which define an overall control strategy. For example, standards supply a baseline to assess progress, identify problems, establish priorities and allocate an area's total acceptable pollutant load among present and future point and nonpoint sources.

Since the public has an opportunity to participate in standards development, critical standards decisions can represent the people's views and enjoy their support. EPA views this safeguard as a key element in the nation's clean water campaign.

Status.—During 1975, the initial standards review requirements (section 303(a)(b)) were essentially completed. (See Table I-1). As of December, 1975 EPA-approved standards were effective in 55 States and other jurisdictions. In 11 States, Federal promulgation actions have been needed.

The present standards define criteria necessary to maintain various beneficial uses of the waters. With few exceptions, all waters are now classified for protection of fish and wildlife and for recreational activities on the water. In addition, all States have classified many of their waters for swimming.

Water quality standards have been used in some segments to determine individual point source controls. To use standards in setting permit conditions, waste load analyses are conducted and total allowable loads are allocated to individual sources and reflected in the permits. Initial waste load analysis has concentrated on oxygen demanding materials in order to define pollutant reductions needed to meet dissolved oxygen criteria, although various other critical parameters have also been included in a number of the analyses. Waste load analyses will be expanded to cover many additional parameters that affect water quality.

Standards Review.—During FY 76 and FY 77, water quality standards will be reviewed and if necessary revised, as provided by section 303(c). The revised standards should be adopted by the State and approved by EPA as the national water quality program moves into the next round of planning and permitting and also implements an expanded program of nonpoint source control.

Revised standards will consist primarily of water use classifications and related criteria. A specific revisions policy will be established during 1976.

TABLE 1
WATER QUALITY STANDARDS STATUS REPORT

State Adoption and EPA Approval Under 303 (a & b), and/or Promulgation Action Initiated and in the Federal Register

State	Date of EPA approval	Promulgation F R. notice	Comment
Alabama	1-29-74 5-23-74	Proposed 7-17-74 Final 11-26-74	Promulgated Fish and Wildlife classification for all waters. State changed WQS after 1-29-74 approval.
Alaska	8-30-73		
American Samoa	10-4-73		
Arizona*	8-1-74 (Partial) 12-30-75	Nutrient Proposed 10-15-74 Salinity Proposed 6-13-74 Salinity Final 12-12-74	EPA will be publishing final nutrient standards in 1976.
Arkansas	10-24-73		
California*	6-20-74 (Partial) Most basins approved as of 12-31-75	Salinity Proposed 6-13-74 Salinity Final 12-18-74	State has adopted and EPA has approved interstate WQS. Intrastate WQS are being revised through basin planning process.
Colorado*	8-13-74	Salinity Proposed 6-13-74 Salinity Final 12-18-74	
Connecticut	12-19-73		
Delaware	5-9-75		
District of Columbia	8-28-73		
Florida	12-20-74		
Georgia	3-23-74 6-12-74 8-18-75		
Guam	6-4-74	Proposed 6-11-74 Final 1-6-75	Promulgated aquatic life criteria for coastal waters and bioassay procedures for toxics.
Hawaii	5-14-74		
Idaho	8-28-73 4-17-75		
Illinois	6-6-74	Proposed 11-28-73 Withdrawn 10-24-74	State adopted EPA requests.
Indiana	8-9-73		
Iowa	3-26-74		
Kansas	8-2-73 5-29-74		Definitions were adopted in the form of emergency regulations.
Kentucky	2-22-74	Proposed 9-26-74 Final 12-2-74	Promulgation action was required as original WQS submitted did not include all waters of the State.
Louisiana	9-17-73		
Maine	12-17-73		
Maryland	7-2-73		
Massachusetts	7-18-74		
Michigan	11-26-73		
Minnesota	11-6-73		
Mississippi	3-6-75		
Missouri	7-13-73	F. R. Notice 11-1-74	F. R. notice was a clarification of previous approval. The "no discharge" provision on the Big Piney River was made exempt from consideration.
Montana	9-23-74		
Nebraska	7-23-73		
Nevada*	6-7-74	Salinity Proposed 6-13-74 Salinity Final 12-12-74	
New Hampshire	12-11-73		
New Jersey	4-25-75	Proposed 12-20-73 Withdrawn 7-24-75	State adopted EPA requests.

TABLE 1
WATER QUALITY STANDARDS STATUS REPORT—Continued

State Adoption and EPA Approval Under 303 (a & b), and/or Promulgation Action Initiated and in the Federal Register—cont'd

State	Date of EPA approval	Promulgation F R. notice	Comment
New Mexico*	10-3-73	Salinity Proposed 6-13-74 Salinity Final 12-12-74	
New York	5-8-74 2-23-75	Proposed 12-20-73 Withdrawn 7-24-75	Final approval excepted from consideration certain portions of the thermal WQS.
North Carolina	11-6-74 8-26-75		
North Dakota	3-12-74		
Ohio	5-14-75	Proposed 5-3-74 Withdrawn 8-7-75	State adopted EPA requests.
Oklahoma	10-24-73		
Oregon	7-30-73 (Partial)	Proposed 2-4-74 Withdrawn 12-10-74	F. R. notice on dissolved gas WQS withdrawal was signed 12-10-74
Pennsylvania	8-10-73 6-28-74 10-30-74 6-23-75		
Puerto Rico	6-26-74	Proposed 9-21-73	State adopted EPA requests.
Rhode Island	12-18-73	Withdrawn 7-24-75	
South Carolina	1-15-73 3-7-73		
South Dakota	7-18-74		
Tennessee	5-14-74 9-2-75		
Texas	10-25-73 7-2-75		
T.T. of Pacific	10-26-73		
Utah*	12-13-73	Salinity Proposed 6-13-74 Salinity Final 12-15-74	
Vermont	1-18-74		
Virginia	8-3-73		
Washington	3-18-74		
West Virginia	7-11-74	Proposed 9-19-73 Withdrawn 12-27-74	State adopted EPA requests.
Wisconsin	4-15-74		
Wyoming*	8-23-73 1-30-75 6-25-75	Salinity Proposed 6-13-74 Salinity Final 12-18-74	
Virgin Islands	11-15-73		

*A salinity control policy and standards procedures was proposed jointly for these seven States. It was signed in final form on 12-18-74

Totals
1. Standards revisions completely approved or promulgation action initiated—55 states or jurisdictions
2. Complete approval or initiation of promulgation action pending—None
3. Total promulgation actions initiated to date—18‡
   a. Promulgations final—10
   b Promulgations pending—1 (Arizona)
   c Promulgations withdrawn—7

‡ 17 States have had promulgation action initiated. Arizona had 2 separate promulgation actions initiated, therefore 18 promulgation actions have been initiated.

Water quality standards should provide for many different uses of water. *(Calumet Park beach, Chicago, Illinois, with power plant in the background.)*

RESTORATION, PRESERVATION AND MAINTENANCE OF WATER QUALITY

The objective of the Act is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." The State's antidegradation policy, an integral part of its water quality standards, determines the extent to which this objective will be achieved. At a minimum, each State's antidegradation policy must assure the following:

- Water uses currently being achieved instream will be maintained and protected.
- Waters with water quality exceeding the minimum level necessary to support the FWPC Act's water quality goal uses will be maintained unless the State decides, after adequate public participation and intergovernmental coordination, to lower the quality because the resulting social and economic development would be necessary and justifiable. In no case, however, could the lowering of water quality impair any existing beneficial water use.
- Waters considered to be an outstanding national resource will not be degraded.

Antidegradation policies have been in effect since before enactment of the 1972 amendments to the FWPC act. The revised water quality management process (see Chapter VI) will include increased emphasis on implementation. Techniques which a State may select to implement its antidegradation policy include:

- Reducing the discharge of pollutants from existing sources and restricting any new discharge of pollutants from new and existing sources.
- Requiring land disposal for new municipal projects.

The Basis for Water Quality Controls

EFFLUENT LIMITATIONS

Introduction

Effluent limitations for a point source discharging to navigable waters derive from two principal FWPCA components: technology-based effluent limitations and water quality standards. An NPDES permit, issued to the discharger, will establish its effluent reduction responsibilities. Normally, technology-based limitations in keeping with EPA guidelines indicate a base level which the source must meet regardless of receiving water quality. If a discharge at that level would nonetheless violate water quality standards, the source's limitations will be made as stringent as necessary to end the violation.

This chapter focuses on EPA's progress and problems in developing technology-based effluent limitations. Water quality standards have been discussed previously. (See Chapter 1.)

In addition, this chapter discusses another regulatory control requirement which qualifies the basic format of national technology limits plus local water quality concern: toxic pollutant discharge standards. When toxic pollutant standards are set by the Administrator, every affected point source must comply.

Municipal effluent limitations

1977 Requirements.—The 1977/78 effluent limitation required by the Act for publicly owned treatment works (POTW's) is secondary treatment. EPA's definition of secondary treatment limits the discharge of biochemical oxygen demand (BOD), suspended solids, and fecal coliform bacteria and delimits an acceptable pH range for the secondary effluent. EPA has proposed an amendment to the definition of secondary treatment (Federal Register August 15, 1975, v. 40 p. 34522) to exclude fecal coliform bacteria, relying on disinfection requirements incorporated into water quality standards.

1983 Requirements.—By 1983, publicly owned treatment works must provide for the application of "best practicable waste treatment technology" (BPWTT). EPA's definition of BPWTT was proposed during 1974 and promulgated October 25, 1975.

Three alternative wastewater management techniques are specified in the regulation, addressed to the three possible modes of wastewater disposal. The disposal options are:

- Treatment and discharge into navigable waters.
- Land application techniques and land utilization practices.
- Reuse.

POTW's providing *treatment and discharge* into navigable waters must continue to achieve a minimum of secondary treatment in 1983. Where factors such as water quality standards or availability of cost-effective technology warrant, the municipality must also provide additional treatment or include the use of other waste management techniques.

A treatment works that employs *land application techniques or land utilization practices* which result in a discharge to navigable waters must

meet the same criteria as works discharging directly into the water. If a POTW land treatment results in wastewater entering the ground water, it must provide protection for any existing or potential drinking water supply use of the underground source. Ground water criteria for any other uses will be determined on a case-by-case basis, taking into account the present and potential use of the ground water.

In the case of *wastewater reuse,* BPWTT limits the allowable quantity of any pollutant in the effluent from the reuse project which is directly attributable to the effluent from the POTW. The attributable portion of the project's effluent may not exceed the amounts which would have been allowed under the POTW's other two alternative disposal options.

Industrial Effluent Limitations

EPA establishes technology-based effluent limitations and standards by promulgating regulations under the combined authorities of sections 301, 304, 306, and 307. These regulations define effluent limitations for industrial sources. Although clearly more binding than "guidelines" in the traditional sense of that word, regulations are generally referred to as effluent limitation guidelines; accordingly, that term is used here.

Effluent limitation guidelines are developed for categories of industries. For the sake of fairness and to prevent unsound geographic variation in environmental safeguards, guidelines for similar sources should establish similar requirements. At the same time, real differences among generally similar sources must be recognized. Distinguishing factors recognized in the law include the age and size of the plant, raw materials, manufacturing processes, the products produced, available treatment technology, energy requirements, and cost. In response to these conflicting needs, EPA has subcategorized industries. The guidelines are uniform for subcategories, but sources within a broad industrial category may be subject to distinct requirements. To date, the agency has identified approximately 500 subcategories within 45 major industrial categories.

EPA defines three levels of treatment technology for each industrial category (or subcategory): best practicable control technology currently available (BPT) for existing sources to be applied by 1977; best available technology economically achievable (BAT) for existing sources to be applied by 1983; and new source performance standards (NSPS) to be applied by all new sources. In addition, pretreatment requirements are specified for both new and existing plants discharging into municipal treatment facilities. As a result, five essentially different treatment levels must be established for each of the 500 subcategories that EPA has identified. Thus, EPA's effluent guidelines will in effect include some 2,500 complex, technical regulations.

Effluent regulations and guidelines define permissible effluents for classes and categories of industrial point sources. *(Kanawha River.)*

Progress in Guidelines Development.—In addressing the enormous guidelines development job, EPA turned first to the 28 industrial categories which the Act expressly requires to be addressed. These categories, known as Group I, have now all been subcategorized. In addition, EPA has identified 18 additional industrial categories that need effluent guidelines. These industries, not specifically mentioned in the Act, have been designated Group II industries.

Guidelines development for Group I has been conducted in two phases. Phase I industries represent those subcategories the Agency felt should have been developed first. Limited resources and the significance of particular subcategories in terms of pollution loads were prime factors in choosing Phase I industries. Effluent guidelines for all Phase I industries were promulgated during 1974. By the end of calendar year 1975, guidelines for eight Phase II categories were promulgated, ten Phase II categories were proposed as interim final, two were proposed, and two were noticed for proposed rulemaking. (See Table II-1).

The magnitude and importance of the effluent guidelines effort has inevitably retarded EPA's ability to complete all of the needed guidelines within the time frame contemplated by the Act. EPA has been sued over the delays and is now subject to a court-ordered schedule for completion. Current activity is focussing on the eight categories still under court-ordered deadlines and on revisions to guidelines which have already been published.

TABLE II-1
EFFLUENT LIMITATIONS GUIDELINES REGULATIONS
GROUP I

Industry	Phase I Date prom in Fed. Reg	Phase II Date prom in Fed Reg.	Date prom in Fed. Reg
Insulation fiberglass	1-22-74	N/A	N/A
Beet sugar	1-31-74	N/A	N/A
Feedlots	2-14-74	N/A	N/A
Glass	2-14-74	8-21-74	1-16-75
Cement	2-20-74	N/A	N/A
Phosphate	2-20-74	1-27-75*	
Rubber	2-21-74	8-23-74	1-10-75
Ferroalloys	2-22-74	2-24-75*	
Asbestos	2-26-74	8-29-74	1-09-75
Meat products	2-28-74	8-28-74	1-03-75
Poultry	N/A	4-24-75	
Inorganic chemicals	3-12-74	5-22-75*	
Cane sugar regining	3-20-74	2-27-75*	
Grain mills	3-20-74	9-17-74	1-03-75
Fruits and vegetables	3-21-74	10-21-75*	
Electroplating	3-28-74	4-24-75*	
Plastics and synthetics	4-5-74	9-20-74	1-23-75
Non-ferrous	4-8-74	2-27-75*	
Fertilizer	4-8-74	10-7-74	1-14-75
Leather tanning	4-9-74	N/A	N/A
Soap and detergent	4-12-74	N/A	N/A
Timber products	4-18-74	8-26-74	1-16-75
Insulation bd. seg.	N/A	8-26-74	
Organic chemicals	4-25-74	N/A	
Petroleum refining	5-9-74	N/A	N/A
Builders paper	5-9-74	N/A	N/A
Dairy	5-28-74	N/A	N/A
Pulp and paper	5-29-74	N/A	
Seafood	6-26-74	1-30-75*	
Iron and Steel	6-28-74		
Foundries	N/A	8-21-75**	
Carbon and alloy	N/A	8-21-75**	
Textiles	7-5-74	N/A	N/A
Steam Electric	10-8-74	N/A	

GROUP II

Industry	Proposed in Federal Register	Promulgated in Federal Register
Paving and roofing	1/10/75	
Paint and ink	2/26/75	
Wood furniture	11/14/74	6/2/75
Oil and gas extraction	8/15/75*	
Mineral mining	10/16/75*	
Coal mining	10-17-75*	
Ore mining	11/6/75*	

* Interim final regulation.
**Advanced notice proposed rulemaking.

Problems

The concept of national technology-based limitations covering all dischargers is a major innovation of the 1972 amendments. These limitations are the foundation for safeguarding the nation's waters from point source pollution. They represent a critically important aspect of the national water quality program, and their economic impact, both on industrial sources and as a regional or national question, can be significant. Effluent guidelines development has unavoidably raised some serious problems.

Technical Problems.—The sheer size of the effluent guidelines development effort has strained the limited resources within the Agency and in the field of qualified technical consultants. Finding a good technical contractor for the work is often difficult. The contractor must be familiar with the field, technically competent, and free from any conflict of interest that could affect its effort. Unfortunately, familiarity and competence often go hand in hand with conflict, making the search difficult. For some categories, very few contractors have knowledge of the field: in these cases the choices become even more limited.

The development of the effluent limitations guidelines involves the following progressive tasks:

- Categorize the industry.
- Characterize the wastes resulting from discharges within the industrial category and each subcategory.
- Select appropriate pollutant parameters.

- Identify the range of control and treatment technology applicable to the discharges from each subcategory.
- Evaluate the available technology with regard to technical and economic factors.
- Select the three levels of technology required by the Act.
- Evaluate the non-water quality environmental impacts including energy requirements.
- Based on the selected technology recommend effluent guidelines for BPT, BAT, NSPS and pretreatment.

Each of these steps is exceedingly complex. Difficult engineering judgments and trade-offs are required to come up with sound guidelines.

Litigation.—When a new agency, working on a new program, promulgates regulations that affect millions of persons in a direct and costly way (with civil and perhaps criminal penalties in the background), an onslaught of lawsuits can well be expected. To date, suits have been filed against many of the industrial effluent guidelines. None of these suits by January, 1976, had resulted in a stay of a final regulation. The proceedings also deflect technical expertise from the Agency's further guidelines development work, thereby impeding work on Phase II and Group II industries and pretreatment. Thus, the litigation has further burdened an already resource-stressed program.

Pretreatment Standards

Many industrial water users do not discharge directly to a stream but rather to a publicly owned treatment works (POTW). Pretreatment standards, sections 307(b) and (c) of the Act are designed to prevent the discharge into the POTW of any substances which could cause fire, explosion, damage to equipment, process upsets, or which could pass through the plant untreated or inadequately treated.

Under EPA's approach, pollutants are classified as either compatible or incompatible. Compatible pollutants are those which are substantially removed by the POTW treatment process; their discharge into the POTW need not be limited. Incompatible pollutants, those not substantially removed by the POTW, will be regulated both through general pretreatment standards and through pretreatment standards developed for individual categories of dischargers.

Regulations promulgated November 8, 1973 (effective December 10, 1973) announce general pretreatment requirements. They define compatible pollutants and limit the discharge of incompatible pollutants to levels prescribed by distinct pretreatment standards for specific industrial categories. As an exception to the limitation on incompatible pollutants, if the POTW is committed in its NPDES permit to remove a specified percentage of any incompatible pollutant, the pretreatment standard applicable to users of such treatment works will be correspondingly reduced for that pollutant.

Both the definition of compatible pollutant and the exception to the limitation in incompatible pollutants have caused problems. Defining a compatible pollutant as one substantially removed by the POTW is clear for certain pollutants but can be ambiguous for a pollutant parameter whose removal efficiency many fluctuate widely over time and from subcategory to subcategory. In addition, the exception allowing credits for incompatible pollutants can be impractical because varying removal efficiencies may result in inadequate treatment at various times.

EPA is planning to revise its pretreatment regulations. The concept of compatible vs. incompatible pollutant will be further refined.

The industry which uses the POTW is not subject to NPDES requirements. EPA has authority in sections 307(d) and 309 to enforce its pretreatment standards directly against the point sources, but with no permit and with often difficult technical problems of measurement and proof, this route is cumbersome.

EPA will instead encourage enforcement of pretreatment standards at the municipal level. This can be accomplished on a voluntary basis if the municipality passes a local pretreatment ordinance. An alternative, which has been used sparingly to date and which may face legal obstacles in the future, is to require in the municipal permit that applicable pretreatment standards be met. In this fashion pretreatment standards could be enforced in conjunction with municipal NPDES permits.

In order for a State to receive NPDES authority, EPA must be assured that the State has authority to enforce pretreatment standards in conjunction with issuing permits to POTW's pursuant to section 402(b)(9). Thus, States which issue NPDES permits will assume authority to enforce pretreatment standards if municipalities in those States fail to do so.

TOXIC POLLUTANTS CONTROL PROGRAM

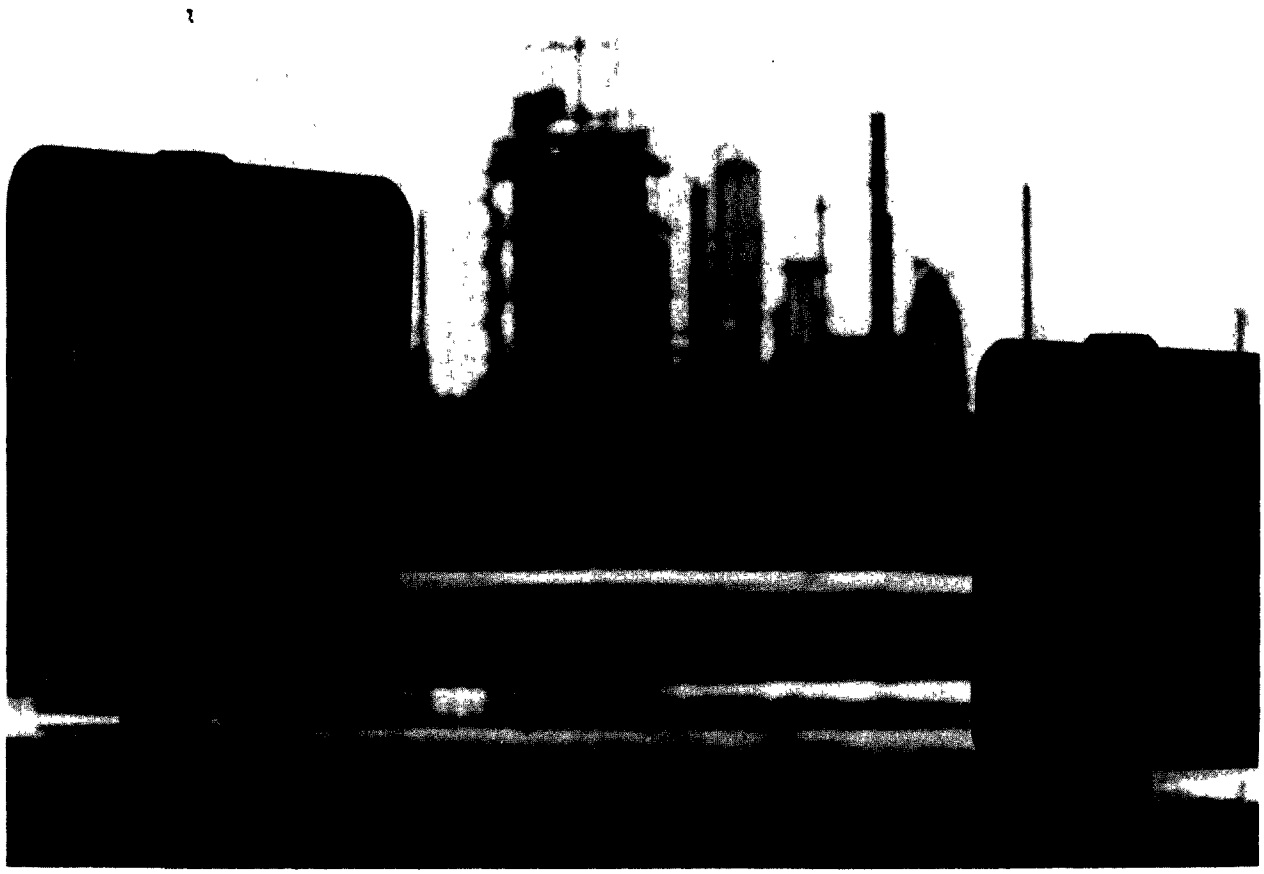
Virtually all substances, including those occurring naturally, are potentially toxic to humans and other organisms. This toxicity is dependent on both the amount of the substance that the organism is exposed to and the length of time the organism is exposed. In some cases, toxic effects occur only after exposure to large amounts of the substance; in other cases, exposure to almost immeasurable amounts result in serious, and often, lethal effects. Regulation of such substances requires a number of alternative control options.

Some 30 Federal laws, under a number of separate agencies, include regulation of toxic substances. Within the Federal Water Pollution Control Act, toxic substance discharges may be controlled in various ways. The program's regulatory bases include effluent limitations guidelines, water quality standards, 307(a) standards, 307(b) and (c) pretreatment authorities, and control of hazardous substances under section 311.

Some categories of effluent guidelines already contain limitations on substances with toxic properties. The electroplating guidelines, for example, limit heavy metals and cyanide, and the steam electric power generating guidelines limit metals, chlorine, and PCB's. During Phase II, guidelines for all industrial categories will be reviewed, and standards for those industries with substantial toxic discharges of such substances will be revised where necessary to include limitations on those substances.

Regulations for hazardous substances were proposed under the authority of section 311 on December 30, 1975. These regulations designate hazardous substances and specify removability, harmful quantities, and penalty rates.

In 1973, EPA promulgated an initial list of nine substances to be regulated by section 307(a) and proposed effluent standards for selected source categories. In April and May of 1974, public hear-



Dangerous toxic wastes can pose a threat to humans as well as to aquatic life. *(Industry near Corpus Christi, Texas.)*

ings on those standards were held. The lack of sufficient evidence in the record prevented promulgation of those standards. During 1975, substantial reworking of the standards occurred and additional information was collected. New standards are scheduled to be proposed in 1976.

By integrating the regulatory provisions of effluent guidelines, toxic pollutant effluent standards in section 307(a), and hazardous substances in section 311, EPA expects to develop a coordinated, Federal toxics control program for toxic water pollutants.

The Application of Controls

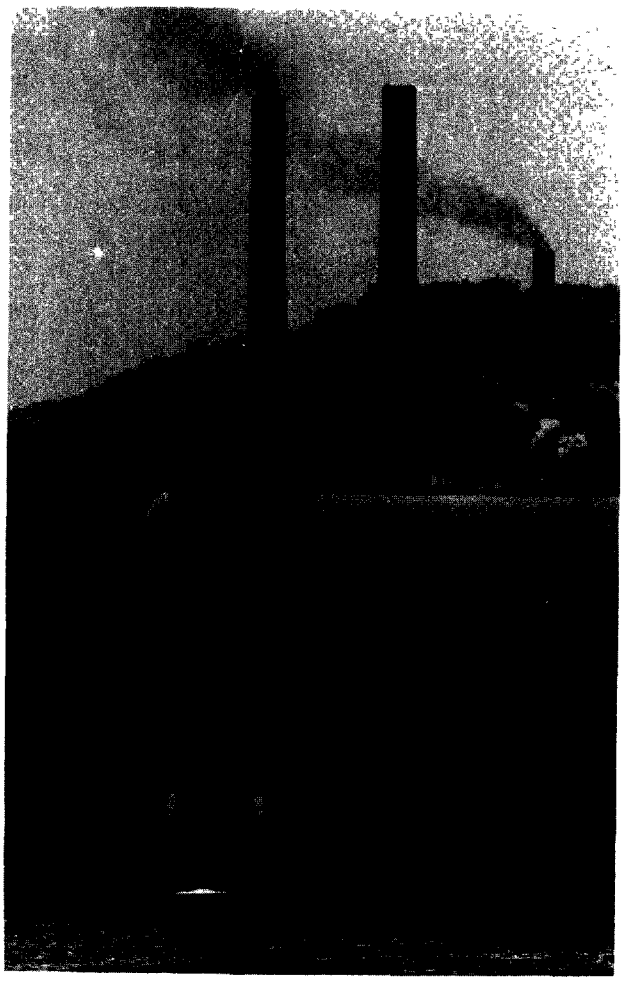
PERMITS

The national pollutant discharge elimination system (NPDES) under section 402 remains the principal vehicle for source by source control of the discharge of pollutants into navigable waters. In 1974, this program, together with construction grant awards, held highest priority among EPA water programs. Administrative responsibility for the program was shared by States and the EPA Regional Offices; the role of EPA Headquarters was largely advisory.

By law, permits are issued for a term of up to five years. They require point source dischargers to comply with applicable FWPCA provisions including technology- or water quality standards-based effluent limitations, new source performance standards, toxic and pretreatment standards, and ocean discharge criteria. They may also absolutely prohibit the discharge of certain substances. Finally, permits include conditions regarding monitoring, recordkeeping, reporting, entry and inspection.

Program Accomplishments During 1974-1975.—The Act expected that all permits were to have been issued by the end of 1974. In all, about 28,000 permits were issued by the end of the calendar year. However, a substantial number of permits, mostly for minor dischargers, had not been issued by that date. Since EPA and the States lacked the resources to process permits properly for all of these sources, activities were prioritized to maximize the program's effect. Highest priority was assigned to issuing the remaining major and new source permits; lower emphasis was given to minor dischargers causing less serious water quality problems.

By the end of 1975, permits had been issued to 95% of all major municipal dischargers; 91% of all major non-municipals; 78% of all minor municipals; and 62% of all minor non-municipals. A total of 45,865 permits had been issued by the end of the year. (Table III-1—III-2). The small number of major permits left unissued are tied up in protracted administrative procedures, primarily at the State level.



By December 31, 1974, most major point sources and many others had been issued discharge permits specifying effluent limitations for their discharges. *(Chemical company along Kanawha River.)*

TABLE III - 1
MUNICIPAL & NON-MUNICIPAL PERMITS BY REGION (EPA & STATES)
December 31, 1975

		Municipal			Non-municipal		
		Permits Issued	Identified Dischargers	Percent Issued	Permits Issued	Identified Dischargers	Percent Issued
I	Major	372	372	100%	436	437	99%
	Minor	288	353	82%	1,129	1,568	72%
II	Major	476	517	92%	508	644	79%
	Minor	632	1,537	41%	710	1,809	39%
III	Major	389	416	94%	392	545	72%
	Minor	1,437	2,785	52%	1,610	4,156	39%
IV	Major	1,258	1,412	89%	1,110	1,199	93%
	Minor	745	1,343	55%	4,206	6004	70%
V	Major	543	567	96%	663	748	89%
	Minor	4,330	5,039	86%	5,334	6,699	80%
VI	Major	356	359	99%	384	370	104%
	Minor	1,532	1,531	100%	1,975	7,350	27%
VII	Major	377	364	104%	215	215	100%
	Minor	1,880	1,784	105%	3,275	3,807	86%
VIII	Major	226	227	99%	166	166	100%
	Minor	807	840	96%	1,384	1,622	85%
IX	Major	223	214	104%	228	217	105%
	Minor	250	250	100%	1,561	1,608	97%
X	Major	155	156	98%	111	114	97%
	Minor	569	598	95%	1,561	2,176	72%
Total	Major	4,375	4,604	95%	4,213	4,655	91%
	Minor	12,470	16,060	78%	22,745	36,799	62%
	Total	16,845	20,664	82%	26,958	41,454	65%

TABLE III - 2
OVERALL STATUS REPORT

PERMITS ISSUED
December 31, 1975

	Major*	Minor	Total
TOTAL			
Issued EPA and States**	8,814	37,051	45,865
Identified Dischargers**.....	9,485	54,695	64,180
Non-municipal			
Issued EPA and States	4,213	22,745	26,958
Identified discharges	4,655	36,799	41,454
Municipal			
Issued EPA and States	4,375	12,470	16,845
Identified discharges	4,604	16,060	20,664

*Major count includes "significant minors"
**Includes EPA-issued Federal facilities permits as follows: 226 major; 1,836 minor; 2,062 total

EPA has continued to encourage the States to assume responsibility for the NPDES program. By the end of 1975, 27 State NPDES programs had been approved. (Table III-3).

Problems in the Municipal Area.—The scale and public cost of the national municipal permit effort, coupled with the tight requirements of the FWPCA, have led inevitably to some serious problems in connection with issuing municipal permits. First, many municipal facilities will not reach the 1977/78 secondary treatment requirement by the statutory deadline. It is estimated that by 1977, 50 percent, or about 9,000, of the municipal treatment plants will provide secondary treatment or some higher level required by water quality. However, less than 40 percent of the 1977 population will be served at the secondary treatment level or better, principally because the large cities will not have had time to complete construction.

Failures to meet requirements may be traced to both financial and physical barriers, and the recently provided availability of the full amount of construction grant monies called for by PL 92-500 will not wholly cure the problems. Due to these uncertainties, many short-term permits were written. During 1975, EPA has reexamined its posture regarding these difficult cases. A significant effort in modification and reissuance of permits is expected.

TABLE III - 3
NPDES PERMIT PROGRAM
December 31, 1975
States and Territories
(alphabetical listing)

Approved	Not approved
1. California	1. Alabama
2. Colorado	2. Alaska
3. Connecticut	3. Arizona
4. Delaware	4. Arkansas
5. Georgia	5. District of Columbia
6. Hawaii	6. Florida
7. Indiana	7. Guam and Trust Territories
8. Kansas	8. Idaho
9. Maryland	9. Illinois
10. Michigan	10. Iowa
11. Minnesota	11. Kentucky
12. Mississippi	12. Louisiana
13. Missouri	13. Maine
14. Montana	14. Massachusetts
15. Nebraska	15. New Hampshire
16. Nevada	16. New Jersey
17. New York	17. New Mexico
18. North Carolina	18. Oklahoma
19. North Dakota	19. Pennsylvania
20. Ohio	20. Puerto Rico
21. Oregon	21. Rhode Island
22. South Carolina	22. South Dakota
23. Vermont	23. Tennessee
24. Virginia	24. Texas
25. Washington	25. Utah
26. Wisconsin	26. Virgin Islands
27. Wyoming	27. West Virginia

An Opportunity for Public Involvement.—The NPDES provides important opportunities for the public to participate in permitting decisions. Public notices are issued for all permit applications, and if sufficient interest is shown public hearings are held. Formal adjudicatory hearings may also be requested by the discharger or other parties.

Adjudicatory requests may be denied under certain circumstances. Issues may be untimely, not subject to hearing or not within the purview of the permit program. Also, the permitting agency may find that the request concerns matters that have been or will be adequately addressed in public hearings.

By December 31, 1975, 1,880 adjudicatory hearings had been requested. Of these, 458 cases were settled prior to hearing, 52 requests were denied, one was settled at the hearing and 1,069 requests were still pending. Although there has been a degree of public interest, the extent of public involvement has often been disappointing.

Current Objectives.—In 1975, NPDES priorities were shifted, since most permits had been issued. Compliance monitoring and enforcement of the issued permits have come to the fore as the logical successors to the past permit effort.

In preparation for the next round of permits, the program is again emphasizing increased State assumption of program responsibilities. Federal and State permit processing is continuing, with dischargers having the most critical effect on water quality receiving the most attention. Permit program areas which will receive highest priority in the near future are: reissuance of municipal permits; issuance, reissuance and modification of major and new source permits, issuance of ocean dumping permits, and preparation of environmental impact statements for new source permits. Adjudicatory hearings on permits will also receive major attention.

Judicial Decisions.—A recent judicial decision calls for expansion of the EPA/State NPDES program. This raises difficult program and policy issues which EPA, and possibly the Congress, may have to reexamine. The District Court for the District of Columbia has held that EPA incorrectly exempted some point sources from the NPDES program. *NRDC v. Train,* Civil Action No. 1629-73, 396 F. Supp. 1393 (March 24, 1975).) Certain feed lots, separate storm sewer outfalls, agricultural and silvicultural discharges are covered by the decision, as defined in the new EPA regulations. EPA is appealing this decision.

COMPLIANCE MONITORING AND ENFORCEMENT

The compliance monitoring and enforcement program polices the EPA/State point source control effort. This program assumes an increasingly central role as source discharge requirements are defined and we move into the period of implementation.

An Important State Role.—The national policy favoring increased State program participation is keenly important in the enforcement area, where appreciation of local circumstances may be particularly valuable. States with EPA-approved permit programs have primary responsibility for monitoring and enforcement of the permits they have reissued or issued either alone or jointly with EPA. In addition, some States without an EPA-approved program have accepted partial responsibility for monitoring. In all cases, Federal and State activity is coordinated, and EPA maintains backup enforcement authority.

EPA or the States may initiate legal proceedings to abate excessive discharges. *(Mining company plant on Lake Superior.)*

The National Compliance Monitoring System.—EPA and States have developed and are implementing a national system for compliance monitoring. The system integrates three agency activities: review of self-monitoring reports, facility inspections, and maintenance of quality assurance activities. Fair and accurate performance is essential throughout the system, since these activities may ultimately support enforcement proceedings.

During 1974, EPA/State resource limitations prevented full review of all sources. Scrutiny focussed on dischargers having the greatest potential impact on water quality.

Mandatory self monitoring, comparable to the national income tax system in terms of individually generated reports, is established through permit conditions. All reports are logged for receipt. Facilities inspections may be prompted by violations apparent on the face of a monitoring report or by random or preselected audits. Inspections may include examinations of production processes, equipment and facilities and the taking of effluent samples. Self monitoring report analysis is coordinated with any inspection of the facility.

Municipal facilities inspections may also look for areas where operations and maintenance activities (O&M) can be improved. Information gathered from O&M inspections is used to upgrade performance. Manpower training for municipal personnel has also been developed to improve performance. (See Chapter IV).

EPA has been developing a data system to assist EPA and the States in conducting and directing monitoring and enforcement activities. Further, a quality assurance program has been established to assure that EPA/State and discharger-related laboratory and field activities are in conformance with EPA guidelines and regulations. This should help assure that the data reports are both accurate and precise.

Enforcement.—Enforcement of permits proceeds under a variety of authorities. Section 309 of the Act (Federal enforcement) is supplemented by section 311 (oil and hazardous substance spill regulations), 307(a) and (b) (toxic and pretreatment effluent standards), and section 404 (dredge and fill requirements). Also, the Agency is empowered to take emergency action pursuant to section 504.

EPA and States with approved permit programs are not the only parties with enforcement powers. Interested citizens may also enforce against the Government and other persons by commencing civil actions under conditions prescribed in section 505.

Enforcement action can also be initiated under other laws. Proceedings begun before the enactment of the Act and retained by the savings clause have continued uninterrupted; other laws, including the Federal Insecticide, Fungicide and Rodenticide Act, Safe Drinking Water Act, Ocean Dumping Act, and Refuse Act have also entrusted EPA and the States with enforcement responsibilities.

In 1974 the enforcement program emphasized assistance to the permit issuance effort, including proceedings against sources which failed to file permit applications. As permit conditions, including construction schedules, become fully effective and enforceable, EPA has begun to place more emphasis on enforcing these provisions.

In conducting enforcement activities primary attention is directed towards those areas where actions will have the greatest beneficial impact on water quality. Priority is given to proceeding against the chronic or recalcitrant violators and others who critically affect water quality.

DISCHARGE OF DREDGED OR FILL MATERIALS

The Army Corps of Engineers is authorized to issue permits for the disposal of dredged or fill materials in navigable waters and to specify disposal sites (section 404). EPA is required to develop guidelines in conjunction with the Corps defining procedures for site specification and use.

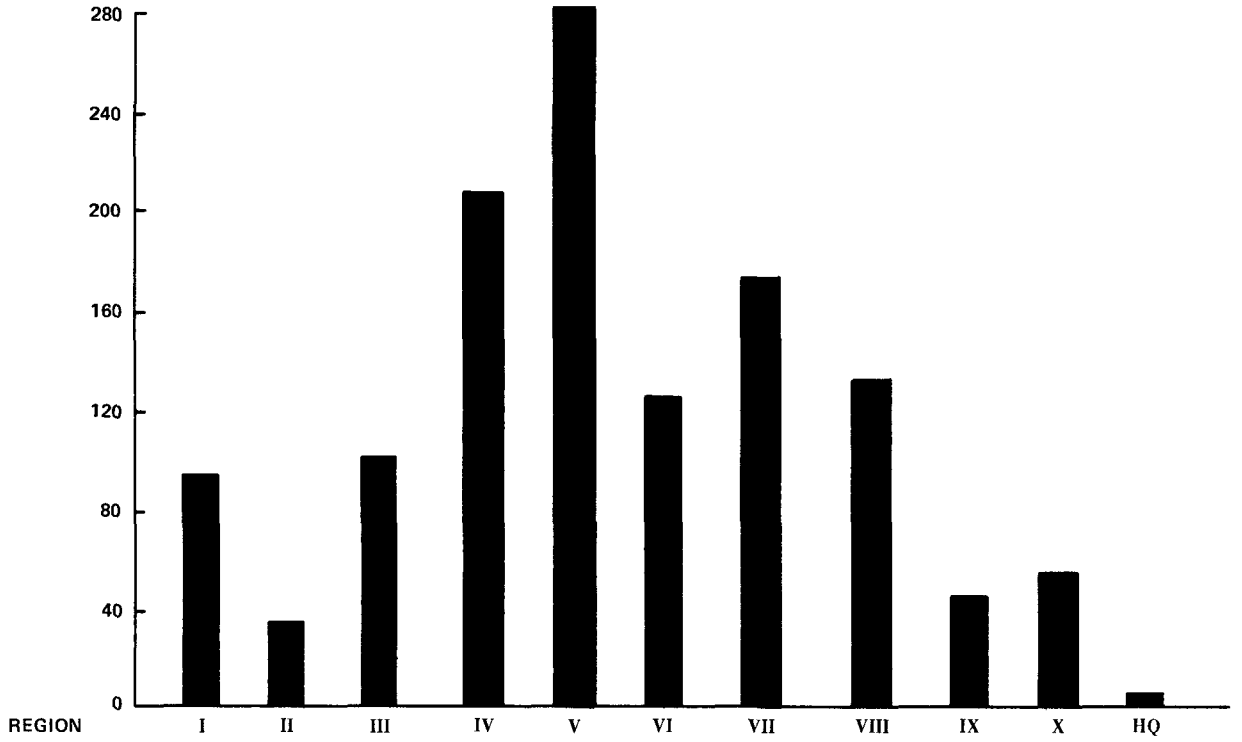
On March 27, 1975, the U.S. District Court for the District of Columbia ruled that the responsibility and authority of the Corps to regulate the discharge of dredged or fill materials extends to "the waters of the United States." Therefore the jurisdiction of the Corp's dredge and fill regulations will be expanded in phases, from traditionally "navigable" waters to all waters covered by the FWPC Act. The Corps has published interim final regulations with varying scopes of application (Federal Register, July 25, 1975) for review and public comment.

EPA published its section 404 guidelines in conjunction with the Corps, also in interim final form (Federal Register, September 5, 1975). The

Legal proceedings against alleged polluters may be brought by private complainants. *(Dead and dying oysters collected as evidence, near New Orleans, La.)*

Figure III-1.

TOTAL ENFORCEMENT ACTIONS INITIATED IN 1974



guidelines are designed to minimize or prevent the harmful effects of the covered activities in waters of the United States, including inland navigable waters.

A significant controversy surrounds coverage of the inland wetlands. Congressional action may resolve this issue.

The proposed guidelines contain safeguards to prevent irreversible damage to waters covered by the guidelines. At the same time undue restrictions must not be imposed on dredge and fill operations needed to maintain navigation, especially in critical port and harbor areas.

EPA is committed to the development and implementation, with the Corps of Engineers and the States, of a realistic, manageable, environmentally-protective, and minimally bureaucratic program for the permitting of the discharge of dredged or fill material. This will be a substantial, ongoing program, to be carried out largely at the Regional and State level.

OIL AND HAZARDOUS MATERIALS

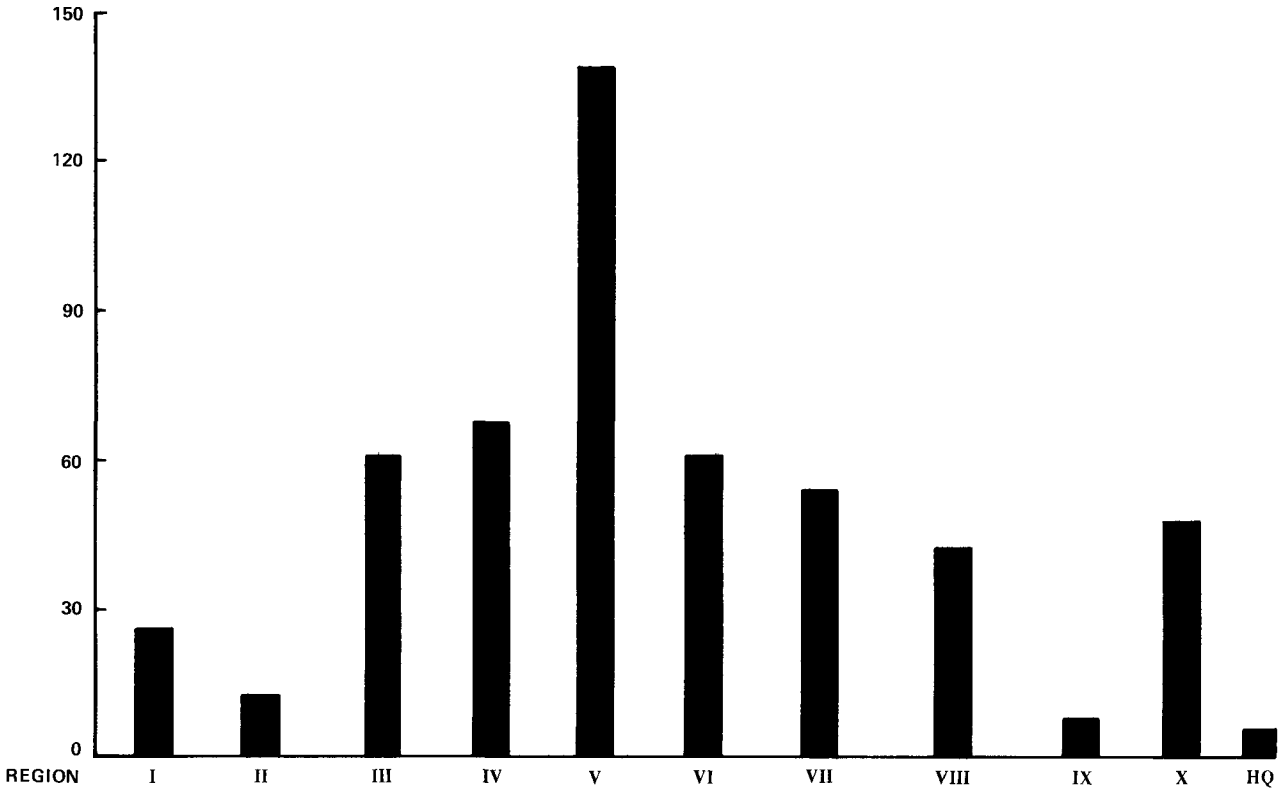
Section 311 of the FWPCA regulates spills and similar discharges of oil and hazardous materials. EPA's primary objectives are to prevent such discharges and, where they do occur, to minimize their environmental and economic impact through containment and removal.

EPA's spill response, prevention and enforcement programs further these objectives. In the past year, program priority was given to response to oil spills and development of remaining regulations. Almost all oil regulations have been promulgated. Four key hazardous substance regulations were proposed at the end of 1975.

Response and Removal.—EPA shares responsibility for the response and removal program with the Coast Guard under the National Contingency Plan (40 CFR 1510). Activities under the Plan are financed by a Federal Revolving Fund. Both the Plan and the Revolving Fund provisions were re-

1974
Figure III-2.

ADMINISTRATIVE ORDERS & NOTICES OF VIOLATIONS TO STATES



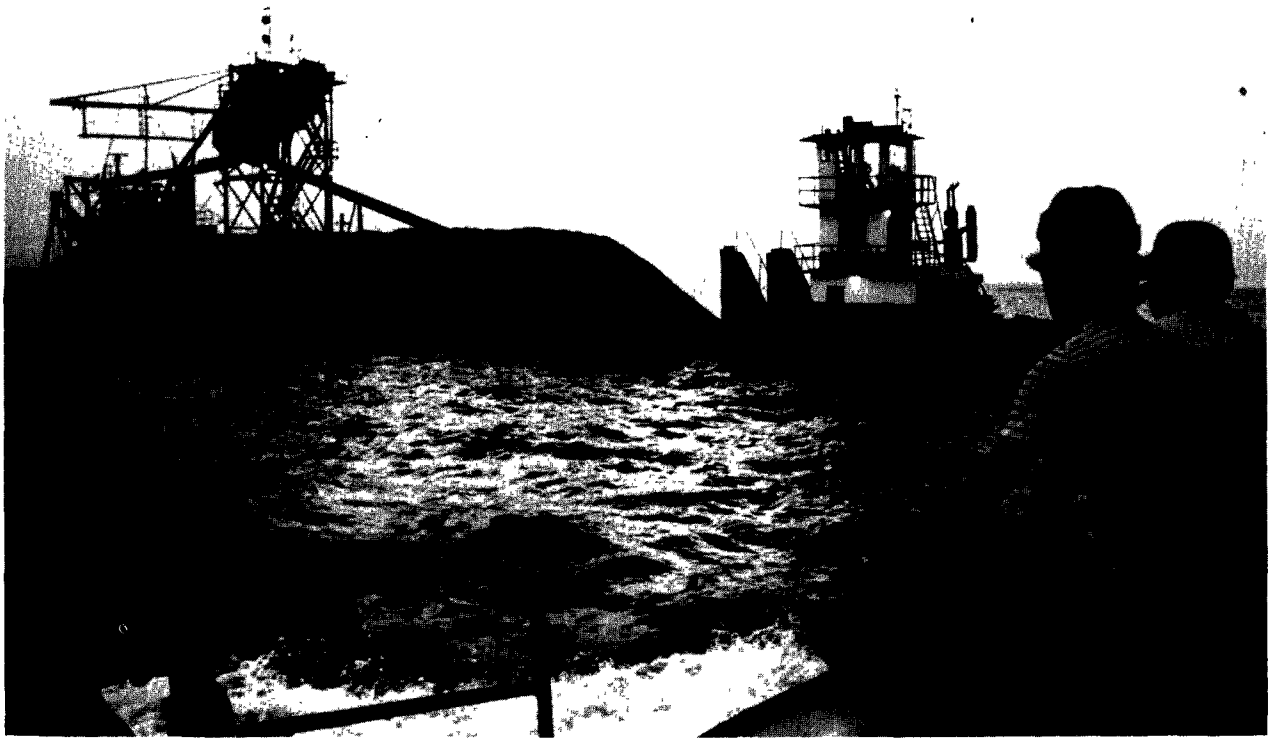
vised in 1974 to incorporate recent developments in the spill program.

Notwithstanding the Revolving Fund, dischargers who spill are expected to take immediate action themselves to contain and remove the substance. If they fail to do so or need extra assistance, the plan is implemented. In either case they are financially responsible for all removal operations.

EPA and the Coast Guard provide Federal on-scene coordinators for discharges to inland and coastal waters, respectively. Each year there are about 13,000 oil spills, 600 spills of hazardous substances and 2000 spills of unknown substances. The number of hazardous substances spills is based on voluntary notification, as mandatory reporting is not yet required. Over the five years it has existed, the Contingency Plan has been invoked over 5,000 times, primarily for oil spills. A total of $18 million of the revolving fund has been expended, part of which has been replenished through the assessment of fines and reimbursement from discharges for Federal clean-up activities.

Prevention. Oil.—The major elements of the oil spill prevention program have been implemented. Regulations which became effective in January 1974 require potential sources to develop and implement Oil Spill Prevention Control and Countermeasure (SPCC) Plans (40 CFR 112). Regional personnel inspect facilities to assure that the required plans have been prepared and implemented. Also, if a discharger has major or repeated spills, its plans will be reviewed and, if necessary, revised. Appropriate enforcement action may be taken against sources with or without plans.

Hazardous Substances.—Proposed regulations designating hazardous substances, determining their removability, establishing harmful quantities and establishing penalty rates were published



Dredging operations must obtain a permit from the Corps of Engineers and meet the joint requirements of EPA and the Corps. *(Lake Pontchartrain, La.)*

December 30, 1975. Final promulgation of these four regulations is anticipated before the end of CY 1977. A supplement to the hazardous substances regulations was issued to support the selection of substances on the designation list. The proposed designation regulation contains 307 hazardous substances which are subject to regulation under section 311.

Enforcement.—EPA's objective is to encourage preventative action, but enforcement measures will be undertaken where necessary. Both the failure to report spills of a harmful quantity and the discharge itself are subject to penalties under Coast Guard administrative procedures. EPA cites violators of the oil pollution prevention regulations. Violations include failure to prepare and implement the required SPCC plans and failure to revise plans as required by facilities which continue to have spill problems. When non-removable hazardous substances are discharged in excess of the harmful quantity, EPA may also assess a civil penalty. Under the proposed hazardous substances regulations, such discharges of non-removable hazardous substances will be subject to either of two penalty provisions. Under one, the penalty could be potentially very high ($500,000 for fixed facilities and $5 million for vessels). Alternatively, a penalty of from $500 to $5,000 per spill event may be assessed.

The choice of penalty options is at the discretion of the Administrator. The penalty rate regulation proposes that gross negligence on the part of the discharger be used as the criterion for deciding which penalty option should apply. Gross negligence in either causing the discharge or in damage mitigation activities may result in the $500,000 or $5 million penalty assessment. Where negligence is not evident, the penalty will be assessed in the range of $500 to $5,000.

The NPDES and section 311 programs both apply to point source dischargers. Some spills may violate both section 311 and an applicable permit. In other instances, there is the potential for a discharge from a fixed facility to exceed section 311 limits for spills but not be in violation of permit limitations for the substances. EPA has

EPA's oil contingency plan regulations provide for quick response to oil spills. *(New York harbor.)*

proposed an exemption for hazardous substances discharges under section 311 as long as they are in accordance with an applicable NPDES permit.

MARINE POLLUTION

The primary objective of EPA's marine program is to protect the quality of ocean waters by regulating the disposal of materials. Almost all intentional ocean discharges, whether in the territorial seas, the contigious zone or the ocean waters beyond, are regulated by section 402, 403, and 404 of the 1972 Amendments of the FWPCA (PL 92-500) or by the Marine Protection, Research and Sanctuaries Act ("Ocean Dumping Act") (PL 92-532 as amended 93-254). Sections 311 and 312 of PL 92-500 regulate the discharge of oil and hazardous materials and section 102 of PL 92-532 regulates fish wastes.

Thus, all ocean dumping is now subject to permit requirements. Only those dumping activities which meet environmentally protective criteria or which are part of an implementation schedule leading toward compliance with such criteria will be permitted.

A comprehensive report on ocean dumping, addressing the implementation of Title I of the Ocean Dumping Act, is submitted to Congress annually.

Marine Sanitation Devices

An estimated 573,000 U.S. vessels and an unknown number of foreign-flag ships may be subject to marine discharge standards. On June 23 1972, EPA promulgated a virtual no-discharge standard, with certain incentive provisions applicable to existing vessels. On January 30, 1975, the Coast Guard promulgated a regulation addressing the design, construction, installation and operation of marine sanitation devices to meet the EPA standard. On October 10, 1975, EPA published a proposed regulation that would modify the 1972 standard, and on January 29, 1976, EPA expects

to promulgate final marine sanitation device standards early in 1976. Responsibility for enforcing the standards is vested in the Coast Guard.

In addition, the FWPCA allows States with the Administrator's concurrence, or the Administrator upon request, to establish strict no-discharge zones to protect or enhance the quality of particular State waters.

Clean Lakes

The FWPC Act authorizes EPA to provide matching grant financial assistance to States to carry out methods and procedures to control sources of pollution and restore the quality of publicly owned freshwater lakes (section 314) and also to enter contracts with or make grants to various persons to develop and demonstrate lake pollution control methods. (Section 104(h).)

Grants approved under the lake restoration program are matched by equal amounts from State or local governments. Initial Federal appropriations were $4 million, about 10 percent of which has been earmarked for use by EPA to evaluate the results achieved. An additional $15 million has been appropriated for Fiscal Year 1976.

EPA's program is directed toward restoring the quality of publicly owned freshwater lakes that have been degraded by pollution from urban or stormwater run-off, chemicals leached from septic tank fields, or run-off from farms and fields. Such sources are contributing an ever greater percentage of the Nation's total water pollution load, since most industrial plants and sewage treatment facilities have already started cleaning up their discharges under the other EPA water pollution control programs.

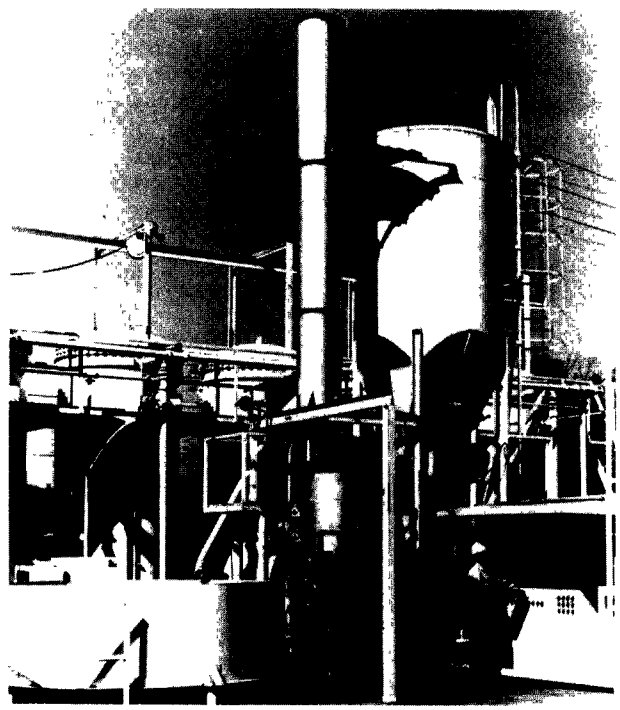
The lake restoration program includes such activities as diverting run-off from storms, farms and feedlots, diking, controlling sedimentation, street cleaning and sweeping to cut pollution from urban run-off, dredging to remove major deposits from plant decay, constructing sediment traps, and promoting the growth of beneficial plants to dispose of excess nutrients. Grant funds may not be used for activities having only temporary beneficial effects, such as weed cutting or chemical treatment to limit the growth of algae.

Note: A series of tables indexing enforcement actions taken under the Federal Water Pollution Control Act Amendments of 1972 during 1974 and 1975 will be separately printed and distributed.

Municipal Construction

Publicly owned treatment facilities play an important role in determining the quality of the Nation's waterways. They handle waste-water generated by 160 million persons—76 percent of our population—plus the effluents from many industries. By 1990, plants are expected to provide sewage treatment for at least 210 million persons.

Cities, towns, and special service districts supply waste treatment ranging from crude to sophisticated for the sewered population. To assure that every community has adequate treatment—secondary treatment plus more stringent treatment where necessary—as rapidly as possible, EPA provides funds for construction to municipalities, supports needed manpower training, and promotes good operation and maintenance practices for new and old plants alike.



Advanced waste treatment technology is often needed to meet standards in the receiving waters. *(Carbon adsorption system. EPA-supported facility at Pomona, Calif.)*

MUNICIPAL CONSTRUCTION

The Federal Water Pollution Control Act of 1956 initiated the program of Federal grants to communities for waste treatment works construction. Since 1956, EPA and its predecessor agencies have obligated over $14 billion for pollution control projects. The total cost of these projects, including State and local shares, was about $27 billion (See Table IV-1.)

In addition to the $18 billion for new treatment works construction, the 1972 Act also authorized $2.75 billion to reimburse communities for the costs of some treatment works construction completed prior to the Act. Subsequent legislation added $600 million to the reimbursement fund. As of June 30, 1975, $1.9 billion had been appropriated for reimbursement.

A Major State Role.—The construction grants program is included in EPA's high priority effort to transfer major responsibility for program operation from EPA to the States. The sizeable manpower requirements of the grants program, along with the program's high dollar value and clear local impacts, underline the importance of this transfer.

EPA supports an amendment to the 1972 Act which would encourage delegation of grant functions to capable States by allowing them to reserve up to two percent of their construction allotments to finance administration of the grants program.

EPA may delegate to States with the necessary authority, responsibility, and capability a substantial portion of the construction grants program. At a minimum, EPA must carry out the provisions of the National Environmental Protection Act

TABLE IV-I
MUNICIPAL CONSTRUCTION
DECEMBER 31, 1975

Annual Authorizations, Allocations, Obligations & Expenditures

Fiscal years	Authorizations	Actual allocations	Fiscal year obligations	Actual outlays
1957	$50,000,000	$50,000,000	$50,000,000	$844,000
1958	50,000,000	45,657,000	45,657,000	16,844,000
1959	50,000,000	46,816,000	46,816,000	36,429,000
1960	50,000,000	46,101,000	46,101,000	40,295,000
1961	50,000,000	45,645,260	45,645,260	44,085,000
1962	80,000,000	80,000,000	80,000,000	42,103,000
1963	90,000,000	90,000,000	90,000,000	51,738,000
1964	100,000,000	90,000,000	89,642,425	66,432,000
1965	100,000,000	90,000,000	88,225,123	69,755,000
1966	150,000,000	121,000,000	120,946,373	81,479,000
1967	150,000,000	150,000,000	150,000,000	84,476,000
1968	450,000,000	203,000,000	203,000,000	122,109,000
1969	700,000,000	214,000,000	214,000,000	134,530,000
1970	1,000,000,000	800,000,000	437,635,609	176,377,000
1971	1,250,000,000	1,000,000,000	1,167,505,913	478,366,000
1972	2,000,000,000	2,000,000,000	872,462,638	413,407,888
1973	7,750,000,000[1]	3,900,000,000[2]	2,926,230,179	684,400,479
1974	6,000,000,000	3,000,000,000	2,669,119,938	1,553,421,169
1975	7,600,000,000[3]	4,000,000,000	4,149,461,347	1,937,574,981
1976	—	9,000,000,000[4]	4,500,000,000*	2,350,000,000*
Transition	—	—	1,000,000,000*	600,000,000*
1977	—	—	6,400,000,000*	3,770,000,000*

[1]Includes $2.75 billion for reimbursement under section 206.
[2]Includes $1.9 billion appropriated for reimbursement.
[3]Includes $600 million for reimbursement (P.L. 93-207).
[4]Release of $9.0 billion in FY73/74/75 authorizations.
*Estimate.

(NEPA) and other mandatory Federal requirements, monitor and audit grants, provide overall management, make formal approvals of grants, and distribute funds. The states can assume some or all other grant-related functions.

The construction grants program for treatment plants and sanitary sewers has five objectives:

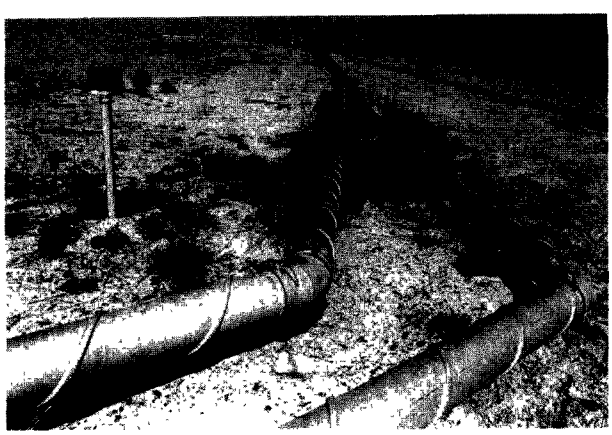
- To manage the program in an efficient manner with sufficient resources to ensure that the effluent limitations and the water quality standards required under the Act are achieved at the least cost and in the minimum possible time.
- To assure that planned facilities are environmentally sound.
- To safeguard the integrity of the program by detecting and deterring fraud and other irregularities in the awarding of grants and construction of the facilities.
- To maintain reliable and efficient operation and maintenance at all plants.
- To transfer from EPA to the States the basic responsibility for the operation of the program.

Three-step Program.—EPA uses a three-step grants program to provide adequate planning, design, and construction. In general, each step must be completed and approved before a grant can be made for the next step. Step 1, Facility Planning, governs the municipal facility investment decision at the local level. Its goal is selection of the most cost-effective and environmentally sound waste management alternative for the planning area. An environmental review, resulting in a negative declaration or an environmental impact statement, must be completed before Step 2 begins. Step 2 consists of preparation of detailed plans and specifications, and Step 3 is actual construction of the project.

Each construction grant represents a lengthy effort by the grant applicant and EPA. Completion of a Step 1 Facility Plan may take six months to a year or more, and preparation of plans and specs under Step 2 can take another year. Both of these steps must be completed before construction can begin.

The Soaring Needs.—Since 1969, EPA has conducted several surveys of municipal facilities to predict the costs of needed treatment works construction in each State. The 1974 Needs Survey was the first survey of projected needs associated with the 1983 goals of the Act as well as the 1977/78 requirements—for many treatment plants, secondary treatment will satisfy the 1983 goals, but special factors including more strict water quality standards may toughen the requirements in some cases. (See Chapter I.) In addition, many of the reporting constraints on the 1973 Needs Survey were removed in 1974, which broadened its scope.

The 1974 Survey, despite certain corrections by EPA, reported that meeting the 1983 goals of the Act would cost the staggering sum of $342 billion. In contrast, the 1973 Needs Survey, just one year earlier, projected total needs of only $60 billion. A major reason for this dramatic leap is the inclusion in the 1974 Survey of a new category of needs—treatment and/or control of stormwater—totalling $235 billion. Also, for the 1974 Survey, EPA accepted *estimates* of the cost of meeting the 1983 goals, whereas the 1973 Survey was designed to show needs for meeting only the 1977 goals, and such needs were to be reported only if they were documented.



Disposal of sludge from municipal waste treatment plants is an increasing problem. *(Chicago's sludge transported for experimental use on Illinois cornfields.)*

EPA does not consider the needs estimates for the new stormwater category to be useful either as an accurate indicator of long-term requirements or for allocating grants among the States. Different States used different assumptions and techniques to estimate their stormwater abatement needs. In some States, the estimate included not only the costs of controlling existing stormwater discharges, but also the costs of providing new storm sewers and stormwater treatment facilities in certain areas currently lacking storm sewers.

However, even when needs are limited to the so-called traditional eligibilities, treatment plants and interceptor sewers, the totals are immense. The 1974 Survey for these components reported a figure of $46 billion. This figure represents a $10 billion, or 28 percent, increase over the preceding year's estimate. The increase resulted partly from a new awareness that future water quality standards may be more stringent than the standards on which the 1973 Survey was based. The presence in the 1974 Survey of more needs for advanced waste treatment in relation to simple secondary treatment supports this explanation.

Awarding Grants for Priority Actions.—The needs surveys are conducted to determine the extent of the pollution problem and to enable Congress to allocate Federal construction funds among the States in proportion to the size of their municipal treatment problems. Of the $18 billion authorized for new treatment works construction in the FWPCA of 1972, over $8.2 billion had been obligated by December, 1975. In FY 1976, EPA plans to award about 4,000 grants for planning, design and construction, totaling about $4.4 billion.

TABLE IV-2
SUMMARY OF CONTRACT AUTHORITY GRANT ACTIVITY UNDER P.L. 92-500

Fiscal year	Authorization	Allotment	Obligations	Expenditures
		(THOUSANDS - $)		
1973	5,000,000	2,000,000	1,591,000	---
1974	6,000,000	3,000,000	1,384,000	160,000
1975	7,600,000	4,000,000	3,616,000*	880,000
1976	—	9,000,000	4,400,000*	1,467,000*
Transition	—	—	1,000,000*	490,000*
1977	—	—	6,000,000*	3,370,000*

*Estimate

TABLE IV-3
STATUS OF WWT CONSTRUCTION GRANT FUNDS UNDER PL 92-500 AS OF DECEMBER 31, 1975

Region	State	Fiscal Year 1973, 1974, 1975 and 1976 Allotments	Obligations	Combined Unobligated
1	Conn.	308,684,700	119,768,607	188,916,093
	Mass.	573,905,000	248,037,826	325,867,174
	Maine	153,097,200	123,786,074	29,311,126
	N.H.	153,817,300	75,683,301	78,133,999
	R. I.	90,908,600	53,461,612	37,446,988
	Vt.	45,397,400	15,265,585	30,131,815
Region totals		1,325,810,200	636,003,005	
2	N.J.	1,300,686,700	662,087,945	638,598,755
	N.Y.	2,089,647,700	773,747,685	1,315,900,015
	P.R.	169,968,400	57,685,014	112,283,386
	V.I.	15,390,700	5,024,250	10,366,450
Region totals		3,575,693,500	1,498,544,894	
3	D.C.	146,295,800	112,449,640	33,846,160
	Del.	111,035,200	46,723,995	64,311,205
	Md.	564,743,400	247,757,280	316,986,120
	Pa.	992,799,000	409,982,341	582,816,659
	Va.	496,196,400	271,382,613	224,813,787
	W. Va.	122,150,600	41,320,532	80,830,068
Region totals		2,433,220,400	1,129,616,401	
4	Ala.	95,821,100	51,418,104	44,402,996
	Fla.	691,686,500	426,027,809	265,658,691
	Ga.	242,575,800	74,896,286	167,679,514
	Ky.	188,609,400	86,112,818	102,496,582
	Miss.	80,756,900	39,971,008	40,785,892
	N.C.	226,984,200	91,719,127	135,265,073
	S.C.	170,538,900	61,748,223	108,790,677
	Tenn.	213,748,200	81,777,569	131,970,631
Region totals		1,910,721,000	913,670,944	
5	Ill.	1,136,455,100	484,895,773	651,559,327
	Ind.	483,619,900	190,574,247	293,045,653
	Mich.	1,213,699,300	537,640,712	676,058,588
	Minn.	337,866,800	170,894,947	166,971,853
	Ohio	979,291,100	458,605,770	520,685,330
	Wis.	284,762,800	141,318,507	143,444,293
Region totals		4,435,695,000	1,983,929,956	
6	Ark.	81,362,800	40,288,711	41,074,089
	La.	154,404,100	71,096,954	83,307,146
	N. Mex.	36,265,400	16,004,763	20,260,637
	Okla.	134,336,100	41,370,200	92,965,900
	Tex.	420,340,100	225,929,191	194,410,909
Region totals		826,708,500	394,689,819	
7	Iowa	197,194,700	92,282,799	104,911,901
	Kans.	112,696,700	34,999,109	77,697,591
	Mo.	314,797,600	174,553,477	140,244,123
	Neb.	77,973,500	38,834,142	39,139,358
Region totals		702,662,500	340,669,527	
8	Colo.	89,874,200	56,026,536	33,847,664
	Mont.	28,222,800	18,321,755	9,901,045
	N. Dak.	12,013,100	7,736,871	4,276,229
	S. Dak.	17,736,800	8,130,107	9,606,693
	Utah	44,996,100	29,849,895	15,146,205
	Wyo.	8,320,100	4,507,152	3,812,948
Region totals		201,163,100	124,572,316	
9	Ariz.	43,259,200	33,394,146	9,865,054
	Calif.	1,894,076,900	761,012,076	1,133,064,824
	Guam	12,931,200	9,883,352	3,047,848
	Hawaii	109,558,300	93,148,350	16,409,950
	Nev.	64,920,400	55,958,345	8,962,055
	Trust Territories	5,087,100	2,957,555	2,129,545
	American Samoa	1,554,900	240,000	1,314,900
Region totals		2,131,388,000	956,593,824	
10	Alaska	51,569,600	32,588,274	18,931,326
	Idaho	38,002,500	22,135,371	15,867,129
	Ore.	154,189,600	93,309,072	60,880,528
	Wash.	213,176,100	118,711,350	94,464,750
Region Totals		456,937,800	266,744,067	
National Totals		18,000,000,000	8,245,034,753	

Appropriate project priorities are an important part of the program, to maximize the public expenditure's impact on water quality and public health hazards. Each year, the States develop municipal project priority lists. Construction grant awards go to identified priority needs, where they can bring about direct improvements in water quality.

EPA has set the goal of obligating the entire $18 billion authorization by the end of FY 1977, to assure that these funds are promptly used to attack the problem of municipal pollution. To achieve this goal, the rate of obligation of available grant funds will have to be accellerated to about $450 million a month, and vigorous, skillful, and efficient grants management will be required. The Administrator has established the principle of having a single EPA project manager for each grant during the entire three-step process, to make sure that grants are processed carefully and smoothly. Major commitments of Federal and already strained State resources will be needed if the grant objectives are to be fully realized. Greater involvement of State personnel is particularly important.

The Agency recognizes that the pressures to accelerate the grants program could lead to great inefficiencies in the way the remaining $12 billion is spent. However, by maintaining proper priorities, by promoting better grants management, and by delegating authority to the States, EPA is insuring against both financial waste and environmental degradation.

TRAINING FOR ASSOCIATED PERSONNEL

The rapidly-increasing rate of wastewater treatment plant construction will seriously magnify current shortages of adequately-trained operation and maintenance personnel. A well-planned and executed manpower planning, development and training program is therefore a key factor in insuring effective use of the billions of dollars being invested in treatment works.

Estimates vary on the demand for and supply of persons to operate and maintain wastewater treatment works. Proposed studies should provide much more accurate information on which to base employment and training needs projections.

One limited survey conducted by EPA in 1974 and based on recommended staffing levels by size and type of plant indicated that approximately 85,000 persons were needed for optimal operation

and maintenance of then-existing facilities. This estimated need was somewhat higher than positions actually budgeted by local governments, and more than 25 percent above the estimated 67,000 full and part-time workers engaged in operation and maintenance activities for municipal plants. This numerical shortage is complicated by the fact that a number of inadequately-trained and inexperienced personnel appear to be filling positions.

In an effort to alleviate this problem and assist the States to achieve self-sufficiency, EPA conducted eight instructor development courses during 1975. A total of 117 persons, from 24 States, were trained as instructors in these intensive, one-week programs. Over three-fourths of those were trained in the area of wastewater treatment. The remainder received instruction in other environmental fields, such as pesticides. Additional courses are scheduled through 1976.

Programs to Meet Needs

A number of programs, not all under the Environmental Protection Agency, are intended to help meet these needs.

Sections 109-112.—The activities of EPA under sections 109-112 of the Act are keyed to development of undergraduate training programs and the construction of state training facilities. EPA provides curriculum development program guidance and support for States and educational institutions desiring to offer undergraduate courses in treatment plant operations and maintenance. Since Fiscal year 1973, EPA has awarded under section 109(a) approximately $331,000 annually to assist 7-10 institutions per year. These grants have supported curriculum and pilot program development, faculty training, student support and part-time student employment within treatment facilities.

Under section 109(b), as of December 1975 EPA had made three grant awards of $250,000 each for the construction of State training facilities to train operation and maintenance personnel. Other States have indicated interest in developing a State training center. These training centers are funded out of the construction grant funds allocated to a State under section 205.

EPA has made no grants under section 111, award of scholarships for undergraduate study.

Section 104(g)(1).—EPA activities under section 104 of the Act represent the major portion of EPA's investment in attempting to assist States and local governments meet their needs for adequately-trained operations and maintenance personnel.

In FY 75, EPA awarded $1.1 million in grants to the States and training institutions under section 104 (g)(1) to support operator training. In addition, States receiving grants under section 106 in FY 75 budgeted approximately $3 million for training purposes, including training for treatment works operations and maintenance.

Section 104(g)(3).—During FY 75, section 104(g)(3)(A) training grants awarded to universities in support of post graduate training amounted to $1.8 million. This program supported 640 professional trainees at 52 universities. Over the past four years, slightly more than one-third of students supported by this program initially became employees of Federal, State, and local governments. (See Tables IV-4, IV-5.) State and Local Fellowships awarded under section 104(g)(3)(B) amounted to $344,000 in FY 75 and supported 74 fellowships for undergraduate and graduate training. The same amount will be awarded in FY 1976, to assist about 55-60 trainees. No awards are planned under this section after FY 76.

TABLE IV-4
SUPPORT FOR POSTGRADUATE TRAINING

(Section 104(g)(3) Program)

	104(g)(3)(A)			104(g)(3)(B)	
Fiscal year	Training appropriation (thousands)	Training awards to universities	Trainees supported	Fellowships appropriation (thousands)	Fellowship awardees
1962	$700	23	—	$100	25
1963	1,100	35	83	300	45
1964	2,000	54	177	474	75
1965	2,000	57	291	617	101
1966	2,500	65	364	710	113
1967	2,910	71	391	650	103
1968	3,365	84	509	633	113
1969	3,300	79	633	600	91
1970	3,800	88	792	600	105
1971	4,565	91	1,243	600	108
1972	4,650**	103	1,295	600	105
1973	2,800	87	962	250	51
1974	2,770	73	845	—	—
1975	2,105	52	640	344*	29*
1976	1,200	33	425	344*	53*
1977	None*	None*	None	?	?

*Change from Research Fellows to State and Local Fellowships
**$1,200 of FY 72 funds supplied in early FY 1973
Source: EPA Records

TABLE IV-5
INITIAL EMPLOYER OF PERSONS SUPPORTED BY TRAINING APPROPRIATIONS
(104(g)(3)(A))

In percent

Employer	Year			
	1972	1973	1974	1975 (estimated)
Government	43.8	33.0	38.1	36.0
Federal	25.3	11.9	14.3	10.7
State and local	18.5	21.1	23.8	25.3
Consultant firms	32.0	39.0	36.8	34.8
Industries	9.2	11.0	9.5	9.0
Teaching, other, unknown	14.9	17.0	15.6	20.2

Source: EPA sample of universities receiving grants

Other Federal Agencies' Programs.—EPA has also attempted to impact other Federal human resource development programs which could be directed to help meet the needs for qualified personnel in the Water Pollution Control Programs. Primary among these are the public employment and training programs under the Comprehensive Employment and Training Act of 1973 (CETA), and the Vocational Technical Training Programs under the Federal/State Vocational Education System.

CETA provides primarily for entry-level training of unemployed persons and for upgrade training. Information currently available to EPA indicates that over $81 million has already been allocated by Prime Sponsors for CETA employment and training in environmental occupations. A substantial percentage of this investment was directed toward the employment and training of 2,187 persons in the water and wastewater fields.

In addition, EPA has worked with the Office of Education (HEW) in an effort to develop and strengthen relationships between State pollution control agencies and State vocational education systems. These systems, if adequately financed and staffed, can provide the needed training for operations and maintenance personnel, and represent one element of a long-term solution to training needs. An EPA-OE interagency agreement will formalize the Federal agencies' roles in encouraging mutual cooperation in the State agencies.

The State Manpower Planning Response

Adequate manpower planning capability in State and local water pollution control agencies is an important part of the establishment of State and local self-sufficiency in water quality programs, and a major EPA goal. Although there is wide variation among States, on the average present manpower planning capability appears to be only about 30 percent of the needed, or optimal, level. EPA has encouraged the use of section 106 grants to State water pollution control agencies for manpower planning positions. During Fiscal Year 1974, EPA trained more than 100 State and local government personnel in manpower planning for waste treatment works.

A recent Memorandum of Agreement between the U.S. Department of Labor and EPA recommended that if a State or local pollution control agency did not possess the manpower planning function, CETA Prime Sponsors should give consideration to the establishment of an environmental manpower planning function within the Prime Sponsor staff.

As manpower planning becomes better established within State and local water pollution control agencies, these agencies should encourage and support local efforts to provide for optimal treatment plant staffing and appropriate salary scales for persons engaged in waste treatment.

SLUDGE DISPOSAL

One of the most perplexing problems in wastewater treatment concerns disposal of the resultant sludges. Approximately 5 million dry tons of sludge are generated annually from municipal treatment works, and the amount continues to increase. Further complicating disposal will be the change in sludge composition. As more stringent treatment techniques are increasingly employed, sludges will contain a wider range of types and greater concentrations of toxic substances such as heavy metals.

Most popular disposal methods—ocean dumping, incineration, land disposal—all have uncertain or negative environmental impacts associated with them. Ocean dumping has been constrained by recent legislation (see Chapter III), and the amount of sludge dumped in oceans is expected to decline. Incineration consumes a considerable amount of energy and may contribute to air pollution in some areas. Land disposal is inhibited in some locations by citizens' attitudes or legal restrictions.

EPA Actions.—The Agency currently is preparing a technical bulletin to assist in evaluating sludge-disposal related aspects of wastewater treatment works grant applications, and has published a contemporary review of sludge processing technology. In addition, the Agency has established a Residual Sludge Working Group whose mission is to coordinate Agency policy development, program planning, and implementation for residual sludges which include municipal, industrial, and pollution control sludges. The major output of this group will be a strategy document for the short and long term management of residual sludges. The strategy will suggest Agency policy, identify ongoing programs, and define gaps and needs for future research.

As standards and regulations published under recent environmental legislation begin to close off water as a disposal medium, municipal sludge disposers can be expected to turn increasingly to land disposal as a means of solving their sludge problems. The need for technical information and regulations for land disposal will become increasingly more acute.

Efficiency of Treatment Works

EPA and the States conduct periodic operation and maintenance (O&M) inspections and evaluations of existing wastewater treatment facilities. These inspections are conducted primarily to assure compliance with permit and grant conditions on facilities constructed with Federal grant funds. The resulting data are used to develop performance summaries and technical documentation. Evaluations of publicly owned treatment works (POTW) performance, compared with their design efficiencies, and other related data serve the following purposes:

- They provide information to agencies responsible for the POTWs.
- They assist planning agencies to make decisions on treatment works construction or upgrading.
- They help Federal and State program personnel to formulate monitoring and assistance programs.

This survey, required by Section 210 of the Act, is derived from O&M inspection reports during 1973-1974. It summarizes the operational status as of the end of 1974 of facilities constructed with Federal assistance. Preliminary results for 1975 are reported at the end of this chapter. A more complete report for 1975 will be published during 1976.

SAMPLE DESCRIPTION AND METHODOLOGY

The results of 960 inspections conducted during calendar years 1973 and 1974 were received and stored in the same way as in previous years,[1] but the analysis of the data has been improved in this year's report in several ways. More complete sample statistics for removal efficiencies were calculated, performance levels and distributions were plotted, and indices of design versus actual performance were used to allow more direct comparisons among all plant types.

The inspection reports in the final survey are divided into the following groups (Tables V-1 and V-2):

	No. of Plants
Group A—Records with enough design and operational data to allow comparisons	386
Group B—records without operational performance data	484
Records disqualified for lack of design data	84
Total	954

The plants in Group A represent waste treatment processes of all sizes and types. The sample contains records from 38 States, with as few as one coming from one State and as many as 78 from another; the median is 15 records per State.

The plants in Group B also represent a full range of treatment process sizes and types. This group contains records from 40 States, with just one coming from each of three States and a total of 52 from one State at the other extreme. The median is ten records per State.

The largest number of plants in Group B (no operating data) were lagoons or stabilization ponds, usually smaller than 1 mgd. Lagoons tended to fall into Group B because (1) the States often require no testing at lagoons; (2) lagoons are seldom heavily staffed and staff personnel are often untrained; and (3) lagoons often have no effluent, so that no testing is needed.

[1] *Clean Water: Report to Congress-1974, p. 55*

TABLE V-1
NUMBER OF MUNICIPAL TREATMENT PLANTS IN SURVEY GROUP A

Type of process	Class 1 (15 + mgd*)	Class 2 (5-15 mgd)	Class 3 (1-5 mgd)	Class 4 (0-1 mgd)	Class 5 (unknown)	Total	Percent
Primary	7	10	10	12	—	39	10.1
Lagoons	—	—	1	16	5	22	5.7
Trickling filters	6	6	60	53	1	126	32.6
Activated sludge	8	20	61	107	4	199	51.6
Total	21	36	132	188	10	386	100.0
Percent	5.4	9.3	34.2	48.6	2.5	100.0	100.0

*Million gallons per day

TABLE V-2
NUMBER OF MUNICIPAL TREATMENT PLANTS WITH INSUFFICIENT OPERATIONAL DATA-GROUP B

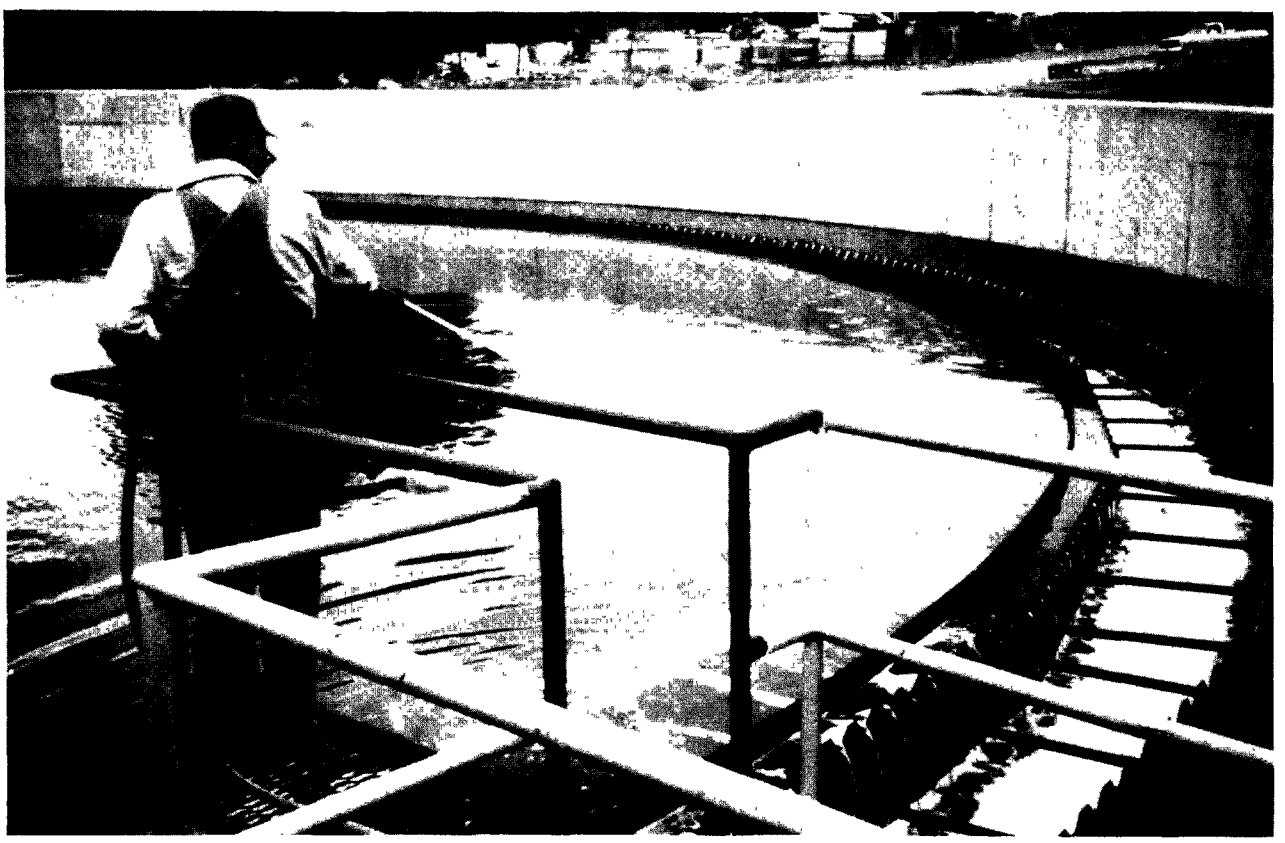
Type of process	Class 1 (15 + mgd*)	Class 2 (5-15 mgd)	Class 3 (1-5 mgd)	Class 4 (0-1 mgd)	Class 5 (unknown)	Total	Percent
Primary	1	6	17	28	3	55	11.3
Lagoons	—	1	12	165	29	207	42.8
Trickling filters	—	2	23	44	4	73	15.1
Activated sludge	—	2	17	119	11	149	30.8
Total	1	11	69	356	47	484	100.0
Percent	.2	2.3	14.3	73.5	9.7	100.1	100.0

*Million gallons per day

GROUP A PLANT PERFORMANCE

As in previous years, plant operational data collected during inspections were analyzed for 5-day biochemical oxygen demand (BOD_5) and total suspended solids (TSS) removals. The performance of Group A plants with respect to these parameters is reflected in two measures: (1) deviations from design parameters for BOD_5 and TSS removal; and (2) comparison of actual effluent quality with the current secondary treatment definition. Additional information on removal BOD_5 and TSS efficiencies by size and type of treatment plant is also presented.

In the analysis, it was found useful to classify the plants based upon their performance record.



Good Plant performance requires constant attention to all aspects of plant operation, from highly complex operational control procedures to routine equipment cleaning and maintenance.

Throughout this section, the following classifications are used:

S—Satisfactory
U—Unsatisfactory but marginal.
P—Poor.

Deviation from Design

Section 210 specifically requires a comparison of actual performance of plants with their design specifications. For this reason, TSS and BOD_5 removals have been converted from straight percentages to indices of deviation from design performance. This method makes it possible to compare the performance of plants over a wide range of design criteria to arrive at more direct comparisons among the various types and sizes of treatment facilities. Table V-3 presents results from the analysis of performance for plants in Group A.

Within Group A, roughly half of the plants were operating at or above their design specifications. Only about 20% of the plants fell more than ten percentage points below design levels for BOD and/or TSS. In terms of achieving design efficiencies, activated sludge plants performed best in BOD_5 removal, with 73% performing well and only 10% performing poorly, as against 60% and 19% for all of Group A. For TSS, activated sludge plant performance closely paralleled overall Group A performance. Primary plants exhibited the best TSS performance, 60% performing well and 31% performing poorly.

Discounting lagoons, of which there were only 28, trickling filter plants had the poorest performance record. Only 45% and 46% operated within design specifications for BOD_5 and TSS respectively. Here again, however, unsatisfactory plants were as often marginal as poor, indicating that a substantial percentage could be brought to acceptable levels by increased attention to operation and maintenance activities. In general, all types of plants appeared to have more trouble with TSS removal than with BOD_5 removal.

While the number of large plants (over 5 mgd) included in the survey sample was relatively

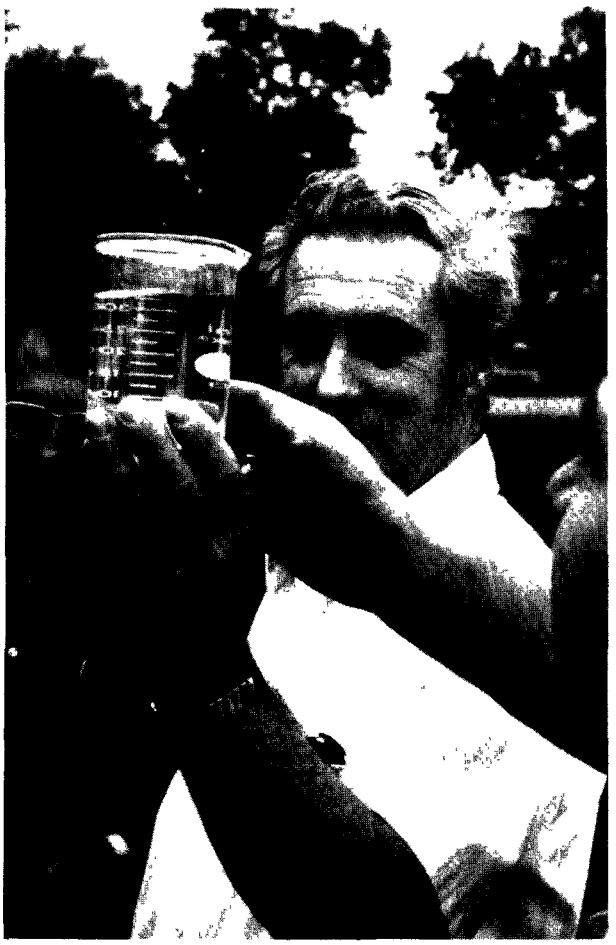
TABLE V-3

DISTRIBUTION OF GROUP A PLANTS BY TYPE, SIZE, AND PERFORMANCE

		Primary						Lagoons						Trickling filter						Activated sludge						Total
		Class 1 (15 mgd*)	Class 2 (5-15 mgd)	Class 3 (1-5 mgd)	Class 4 (o-1 mgd)	Class 5 (un-known)	All	Class 1 (15+ mgd*)	Class 2 (5-15 mgd)*	Class 3 (1-5 mgd)	Class 4 (o-1 mgd)	Class 5 (un-known)	All	Class 1 (15+ mgd)	Class 2 (5-15 mgd)	Class 3 (1-5 mgd)	Class 4 (0-1 mgd)	Class 5 (un-known)	All	Class 1 (15+ mgd*)	Class 2 5-15 mgd)	Class 3 (1-5 mgd)	Class 4 (o-1 mgd)	Class 5 (un-known)	All	
Bod Performance	Sat. (S)	4	7	5	7	-	23	-	-	-	9	1	10	3	2	25	27	-	57	2	9	41	88	1	141	231
	Unsat. (U)	1	1	3	1	-	6	-	-	1	6	3	10	3	2	17	11	1	34	1	7	9	14	1	32	82
	Poor (P)	3	2	2	3	-	10	-	-	1	5	2	8	-	2	17	16	-	35	4	4	6	5	1	20	73
TSS Performance	Sat. (S)	5	4	6	7	-	22	-	-	-	1	1	2	3	1	21.	22	-	47	1	7	27	49	1	85	156
	Unsat. (s)	-	3	1	4	-	8	-	-	-	2	-	2	2	1	14	9	-	26	1	4	13	18	-	36	72
	Poor (P)	3	2	2	-	-	7	-	-	-	1	-	1	-	3	15	12	-	30	5	7	10	15	2	39	77
	No. Data	-	1	1	-		2	-	-	2	16	5	23	1	1	9	11	1	23	-	2	6	25	-	33	81
	Total	8	10	10	11		39	-		2	20	6	28	6	6	59	54	1	126	7	20	56	107	3	193	386

Million gallons per day

small, there does seem to be a pattern of poorer performance by these larger plants. Among activated sludge and trickling filter plants, only slightly over 40% of the large facilities exhibited acceptable BOD_5 removals as against 64% of the smaller plants. Only in the case of primary facilities did large plants perform as well as the sample population in general. As with the smaller facilities, large plants generally were less successful in meeting TSS design criteria. By this latter measure, activated sludge plants operated most poorly, with only 32% of plants over 5 mgd operating satisfactorily.



Federal law, through NPDES permits, requires high quality effluent. This can only be achieved through cooperation among Federal, State, and local agencies concerned with improving plant performance.

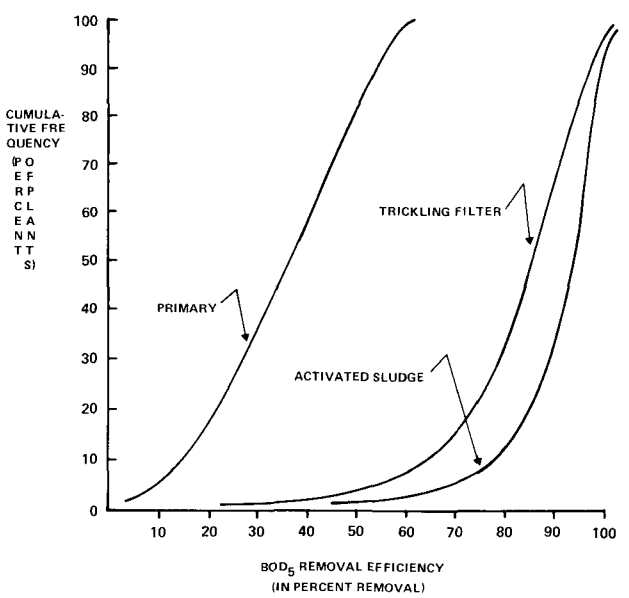
Removal Efficiencies Summary

Basic removal efficiency, presented as a percentage reduction of pollutants coming into the plant, shows the plant's performance in absolute terms, independent of its design efficiency. On the average all Group A plants had a BOD_5 removal efficiency of 80% and a TSS efficiency of 79%. A summary of sample statistics on removal efficiencies is shown in Table V-4. Figures V-1 and V-2 show the distribution of plant performance in relation to the measures presented in the table.

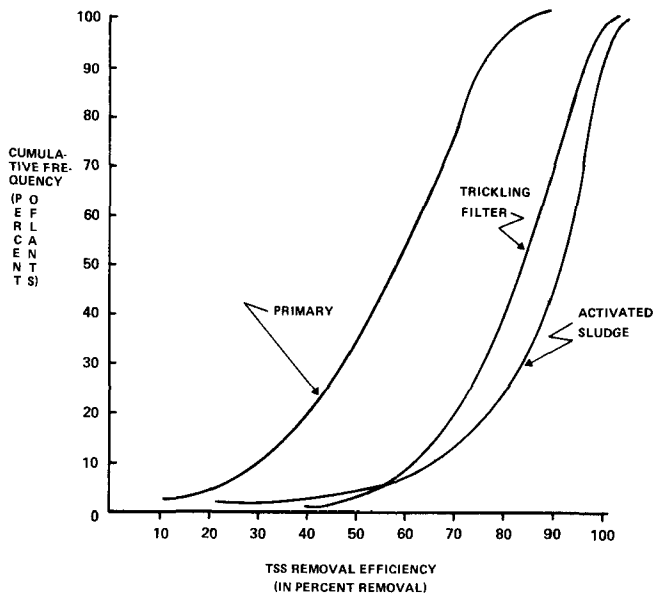
TABLE V-4
STATISTICAL SUMMARY OF BOD AND TSS REMOVAL EFFICIENCIES

	Type plant	Percent removal: Median	Mean	Standard deviation	Number of plants in sample
BOD Efficiency	Primary	35	39	18.0	39
	Lagoons	—	81	9.2	28
	Trickling filter	84	81	14.2	126
	Activated sludge	92	89	10.2	193
	All plants		80	19.7	386
Suspended Solids Efficiency	Primary	56	55	18.1	42
	Lagoons	----- Insufficient cases -----			8
	Trickling filter	82	79	14.7	108
	Activated sludge	89	83	18.0	163
	All plants		79	19.1	321

1974
Figure V-1



1974
Figure V-2.



Compliance With Secondary Treatment Requirements

Comparing the efficiency of plants to their own design standards is an effective measure for design efficiency, but it does not indicate compliance or noncompliance with Federal secondary treatment requirements. Currently, these requirements for BOD_5 and TSS are as follows:

- Not more than 30 mg/l for either parameter where influent concentrations are greater than 200 mg/l or;
- Not less than 85% removal for plants with influent concentrations less than 200 mg/l.

This section reviews compliance with the secondary treatment requirement for those trickling filter and activated sludge plants where both BOD_5 and TSS data were available. As in previous sections, a satisfactory classification of "S" was assigned only if *both* BOD_5 and TSS removals were within the relevant limitations. If either or both measures fell between 30 and 40 mg/l or 75% and 85% removal a "U" (unsatisfactory but marginal) classification was assigned. All others were classified "p" (poor). Under this definition, some 42% of the plants were satisfactory; the remainder were unsatisfactory with the greater number falling in the poor performance category. (Table V-5.)

TABLE V-5
POTW COMPLIANCE WITH SECONDARY STANDARDS FOR BOD AND TSS

	Trickling filter		Activated sludge		Both	
	Number plants	Percent	Number plants	Percent	Number plants	Percent
S	27	25	88	54	115	42
U	28	26	31	19	59	22
P	53	49	44	27	97	36
Total	108	100	163	100	271	100

OPERATIONAL DEFICIENCIES GROUPS A AND B

Satisfactory operation and maintenance of a publicly owned treatment works is critical to the plant's overall performance. General data on operation and maintenance problems and deficiencies for plants in Groups A and B is shown in Table V-6. Major problems include inadequate laboratory testing, deficient management practices and the incidence of substantial deficiencies requiring follow-up action. While differences were not statistically significant, the data trend shows generally that the satisfactory Group A plants have lower incidence of operation and maintenance problems than the unsatisfactory Group A plants and the Group B plants.

Laboratory testing, records keeping, and reporting are major problems, particularly in Group B plants. From the plant size and type distribution for Group B (Table V-2), it is apparent that the laboratory testing and reporting failure remains predominantly a characteristic of the small plants, especially primary treatment plants and lagoons. Many of these plants do not have the equipment or trained personnel to conduct the necessary laboratory analyses, and in many cases they have not been required to report test results.

Only 29% of the Group B plants showed any laboratory analysis at all. Where lab analysis was indicated, most showed only dissolved oxygen, chlorine residual, or settleable solids testing.

Laboratory deficiencies of Group B plants were further summarized, based on available information. This summary omits stabilization ponds (which often have no effluent, so that no testing is needed), other plants where no testing is needed, and those plants where reasons for laboratory

TABLE V-6
OPERATION AND MAINTENANCE PROBLEMS AND DEFICIENCIES

Problems and deficiencies	Frequency of occurrence (%)		
	Group A (Meeting design criteria)	Group A (Not meeting design criteria)	Group B
Have inadequate laboratory facilities and/or inadequate laboratory testing programs.	20	22	71[1]
Have no O&M manuals designed specifically for them.	40	51	48
Inadequate spare parts inventories.	21	26	27
Inadequate records of maintenance repairs and replacement.	11	17	34
Inadequate routine maintenance schedules.	11	13	18
Need follow-up actions to correct operational, mechanical, or manpower deficiencies.	36	37	83
Operations and other plant personnel do not routinely attend short courses, school, or other training.	16	14	36
Infiltration/inflow, major or minor.	75	74	55
Hydraulically overloaded.	18	25	18[2]

[1]Most of these facilities are primary treatment plants and lagoons, smaller than 1 mgd

[2]Based on only Group B plants having both design and average daily flow rates

deficiencies were unknown. The reasons for inadequate laboratory testing are as follows:

- 69% (126 plants) have no testing program established or infrequent current testing, or need additional tests.
- 24% (43 plants) have no lab equipment, no lab facility, or insufficient testing equipment
- 7% (12 plants) have inadequate manpower and training for lab testing.

O&M management, as reflected by the percentage of plants that have inadequate spare parts inventories, maintenance records, and maintenance schedules, is better in the satisfactory Group A facilities than in the unsatisfactory Group A and the Group B plants. Group B plants had the worst record for these three items.

The next most important item is the need for follow-up action. While the percentage of Group B plants requiring follow-up was more than double that for either segment of Group A, the percentages were quite high for the entire sample. Data available for this survey were inadequate to provide a detailed analysis of the types and extent of follow-up needs, but it is apparent that this area should receive more emphasis.

The unavailability of O&M manuals was a problem for a high percentage of all plants in the survey. Here again, more plants in the unsatisfactory category of Group A, and in Group B, lacked specially prepared manuals. In addition, infiltration/inflow was present in a majority of all plants; this appears to be a problem regardless of performance. Finally, overloading also presents a problem in about 20% of the cases.

The elements of treatment plant operation most often cited for deficiencies in operation and maintenance of Group B are as follows:

1. Laboratory controls ..... 268 cases
2. Flow meter and recorder 193
3. Records 90
4. Condition and appearance of grounds 71
5. Safety features 51
6. Pump station 47
7. Effluent chlorine 39
8. Chlorine contact tank 26
9. Chlorinators 25
10. Sludge drying beds 24

Deficiencies in laboratory facilities and analysis continue to be a major problem in improving treatment plant performance.

SUMMARY OF EFFICIENCY IMPROVEMENT ACTIVITIES

The implementation of the comprehensive municipal operations strategy, discussed last year,[2] accelerated in 1974. The NPDES permit system is now being more closely linked with the improvement of the operational efficiency of plants. The technical assistance program, an essential element of the strategy, has seen some success and is receiving increasing emphasis.

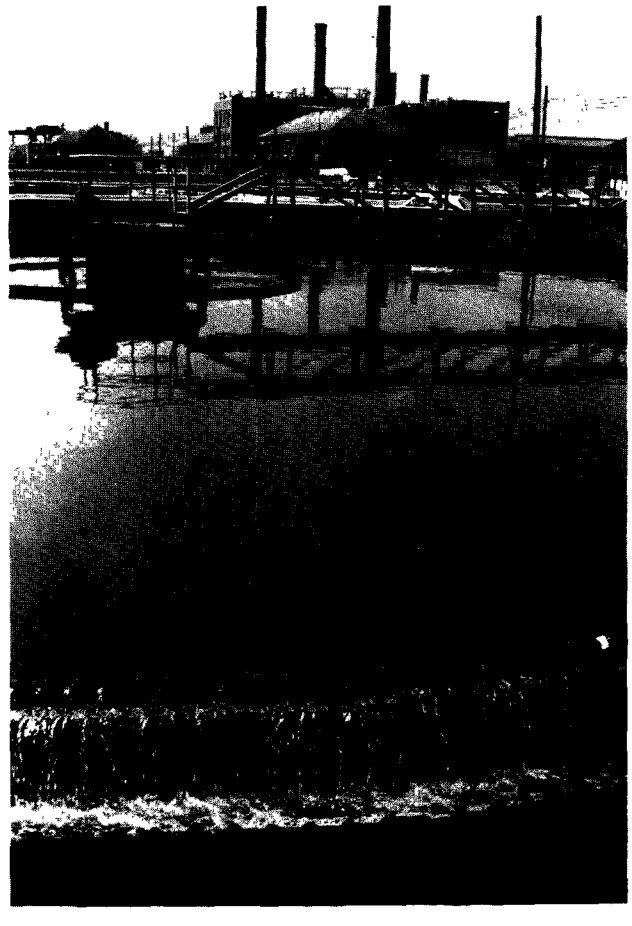
The technical assistance activity is directed to helping municipalities identify and solve operation and maintenance problems which cause inefficient plant performance, and to training State and local personnel in procedures to improve plant performance. Each project provides on-the-job training of the facility's operating technicians, enabling the community to maintain consistently higher pollutant removals. Depending on the situations of individual plants, operations personnel are taught how to respond to changes in hydraulic and organic loadings, how to identify and eliminate or reduce the effects of industrial discharges into municipal systems, and how to improve their laboratory testing programs.

In many cases, pollutant removals increase dramatically. For example, EPA Region IV provided assistance at a 7.0 mgd activated sludge plant, increasing the BOD_5 removal efficiency from 38 to 91 percent. The TSS removal efficiency increased from 20 to 77 percent. These increases, as well as internal plant process improvements, brought the plant from poor to satisfactory.

Of particular importance in the development of the technical assistance program is the increasing involvement of State water pollution control agencies. Several States have begun to develop independent ability to provide operational assistance to their municipal treatment facilities. This trend must be encouraged. The U.S. EPA cannot provide all necessary technical assistance and therefore intends to guide and help the States in developing their own programs.

In addition to technical assistance, EPA has undertaken a variety of other efforts to aid those concerned with proper plant operation. The following are the most significant activities:

- Through the use of contracts, a series of technical documents on O&M is being published, to increase the amount of established knowledge easily available to plant operations personnel.
- A "mini-documentary" (two-minute public information film) on O&M released to 100 selected television stations in late 1975.
- A series of seminars for consulting engineers and State and Federal personnel on the preparation and review of O&M manuals for individual plants has been conducted throughout the country.
- A continuing series of technical workshops has been instituted to improve the capability of EPA Regional personnel in dealing with treatment plant operational problems.
- Training courses are being developed and presented for treatment plant inspectors and performance evaluators and troubleshooters.



Technical assistance to municipalities will help them improve plant operations to meet permit conditions and reduce the pollution load on receiving waters.

[2]*Clean Water: Report to Congress-1974, pp. 60-61*

CONCLUSIONS, 1974

The data collected for this report are consistent with data collected for the two earlier reports (*Clean Water: Report to Congress-1973, 1974*), and are distributed by size and type much as is the national population of plants. Therefore, from the prior performance data review, it may be inferred that significant improvement in operational efficiency could be achieved by means of:

- Improved techniques, procedures, and guidance for suspended solids removal (which appears to be a problem for all types and sizes of plants);
- Improved inspection, evaluation, and technical assistance for larger plants, particularly trickling filter and activated sludge plants, and for marginal plants of all kinds where only a few points of improvement could bring performance to satisfactory levels;
- Increased attention to the problems of trickling filter plants, with special attention to identifying problems sensitive to improvement through better O&M.

The above items are based on operational performance. Several additional needs, based on analysis of plant problems, have been identified.

- Inadequate laboratory testing is still the most prevalent problem and presents a major difficulty in assessing the operational efficiency of plants.
- Special attention to means for encouraging States and municipalities to improve laboratory controls and reporting is needed.

There is a consistent pattern reflecting higher incidence of certain types of problems among Group A plants not meeting requirements and among Group B plants. For this reason, other problems which merit special attention are:

- Substantial improvement is needed in O&M management, particularly maintenance record and supply inventory management.
- New and improved training delivery systems must be provided; and State and municipal agencies must be encouraged to ensure that more personnel are given training opportunities. (See Chapter IV).
- Special attention must be given to inspection follow-up activities, to determine more precisely what the impact of such actions has been, and to identify more precisely the nature of deficiencies and of needed assistance.
- More concentrated effort is needed to ensure the availability of well-written and specially prepared operation and maintenance manuals at all plants.
- A special effort is needed to increase the level of public awareness of, and support for, improved municipal treatment plant performance to protect the public's investment in these facilities.

Preliminary Results on the Efficiency of Treatment

PRELIMINARY RESULTS ON THE EFFICIENCY OF TREATMENT PLANT OPERATIONS—1975

The preliminary results for 1259 inspections conducted during the period January 1974 to May 1975 are reported below. These results provide the design efficiency data required by Section 210 of the Act. More detailed analyses which parallel and extend the 1974 results reported above are being performed and will be published separately.

As in previous years, the 1975 survey, to be reported during 1976, is divided into the following groups: (Tables V-7 and V-8).

Table V-7

NUMBER OF MUNICIPAL TREATMENT PLANTS IN SURVEY GROUP A

Type of Process	Class 1 (15+ MGD*)	Class 2 (5–15 MGD)	Class 3 (1–5 MDG)	Class 4 (0–1 MGD)	Class 5 (Unknown)	Total	Percent
Primary	8	11	33	12	1	65	8.1
Lagoons	1	2	9	60	0	72	9.0
Trickling Filter	11	36	125	65	2	239	29.8
Activated Sludge	25	67	152	178	5	427	53.2
TOTAL	45	116	319	315	8	803	100
PERCENT	5.6	14.5	39.7	39.2	1.0	100.0	

*Million Gallons per day.

Table V-8

NUMBER OF MUNICIPAL TREATMENT PLANTS WITH INSUFFICIENT OPERATIONAL DATA - GROUP B

Type of Process	Class 1 (15+ MGD*)	Class 2 (5–15 MGD)	Class 3 (1–5 MGD)	Class 4 (0–1 MGD)	Class 5 (Unknown)	Total	Percent
Primary	0	3	19	18	2	42	9.2
Lagoons	0	4	16	134	22	176	38.6
Trickling Filter	2	4	39	56	4	105	23.0
Activated Sludge	1	3	32	95	2	133	29.2
TOTAL	3	14	106	303	30	456	100.0
PERCENT	0.7	3.1	23.3	66.5	6.6	100.0	

*Million gallons per day

Group A—Records with enough design and operational data to allow comparisons	803
Group B—Records without operational performance data	456
TOTAL	1259

Group A contains records from 47 States, with as few as 1 coming from two States and as many as 96 from one State; the median is 14 records per State.

Group B contains records from 41 States, with just one coming from each of seven States and a total of 52 from one State at the other extreme. The median is eight records per State.

In the 1975 survey sample inspection emphasis (as indicated by sample distribution) has shifted to a greater proportion of large plants than in previous years.

Changes in grant funding and secondary treatment requirements is evidenced by decreases in primary and trickling filter plants this year versus increases in activated sludge and lagoons.

Performance vs. Design Intent—Group A

The operational performance data for treatment facilities in Group A were scanned to determine plant performance compliance with original design objectives. The main results of this preliminary analysis indicate that 66% of all plants are meeting their BOD_5 design criteria. Also, 59% are meeting their design criteria for total suspended solids. The results by plant type are summarized in Table V-9.

This year's data is consistent with results of previous surveys.

Table V-9

SUMMARY OF OPERATIONAL EFFICIENCY FACILITIES MEETING DESIGN CRITERIA 1976

Type Of Process	BOD_5	TSS
Primary	78%	72%
Lagoons	59%	50%
Trickling Filters	52%	48%
Activated Sludge	74%	64%
All Plants	66%	59%

Program Planning and Management

A COMMITMENT TO INTEGRATED PLANNING

From the earliest version of the legislation that resulted in P.L. 92-500, Congress recognized that achieving desired water quality may require more effluent control than is attainable through base level technology, and that incoherent and uncoordinated planning and management is perhaps the principal cause of inefficiency and poor performance in waste management, particularly in metropolitan regions. EPA shares those beliefs. The Agency, working with State and local authorities and the public, has made major progress since enactment of the 1972 Amendments toward the formulation of an integrated national water quality planning and management system.

Three tiers of government—Federal, State and local—share the responsibility for carrying out an adequate and efficient water quality control program. Efforts at each level are being coordinated to achieve meaningful and reasonable results.

Duties and opportunities under the FWPCA cut across individual sections of the Act. For example, State water quality management is based on the State's planning process called for by section 303(e), but the process merges various statutory requirements. The State's process should satisfy, at the least, requirements of areawide planning (section 208), waste load analysis (303(d)) and water quality reporting (305(b)).

For each type of planning, programs are developed in accordance with stated objectives. Management actions must provide for:

- Assessing the problem.
- Defining priorities.
- Setting targets.
- Developing output commitments.
- Insuring that adequate management and regulatory actions are provided to carry out the program.
- Tracking major milestone achievements and water quality changes.

Preparation of complete and comprehensive programs for all sources and concerns in a planning area may outrun the management agency's resources. Hence, EPA and the other agencies have prioritized objectives, to tackle the most important needs first. Past objectives have emphasized completion of basic water quality standards, development of initial basin plans, designation of areawide planning areas and agencies, and initial structuring of the management program. The coming period will focus on revising water quality standards during FY 1976 to reflect the Act's 1983 national water quality goal as specified in section 101(a)(2); conducting water quality planning to establish targets for Phase II permits where base-level BAT will be inadequate to reach that goal; and implementing areawide waste treatment management planning by designated agencies and the States, including coverage of nonpoint sources of pollutants.

THE COMPONENTS OF THE SYSTEM

From a broad perspective, the water quality planning and management system includes three major aspects. These are: the national strategy and program guidance; individual State strategies and program plans; and specific State or areawide planning and management. Other associated planning has to date played only a minor role in the overall effort.

Careful planning and management is needed to protect ecologically valuable salt marshes from excessive development. *(EPA biologist studying marsh conditions near Pensacola, Florida.)*

Federal and State Strategies; Federal Program Guidance

Each year EPA prepares two important documents:

- *The Water Quality Strategy Paper,* to provide an overview of program objectives and indicate developing national policies.
- *The Management by Objectives Operating Guidance,* to describe individual program priorities, outputs, narrative descriptions and reporting requirements.

Each State prepares an individual State water quality strategy that corresponds to the Federal strategy and operating guidance. The State strategy lists problems and geographical priorities, outlines the State's approach and establishes priorities and schedules for specific actions. The State strategy, updated annually, becomes an integral part of the State program.

The State Program

Section 106 of the Act authorizes EPA to make annual allotments to the States and interstate agencies based on the extent of the pollution problem in the several States. EPA grants supplement State funding and strengthen the capacity of State agencies to achieve the goals established by the Act.

Federal expenditures have grown from $10 million in FY 1968 to $48.5 million in FY 1975. At the same time State expenditures have shown an even greater increase, from $19 million in FY 1968 to $80 million in FY 1975.

A Growing State Effort.—One of the major directives of the Act is the delegation for administration of programs by the States. As of the end of FY 1975, 24 States had been delegated permit authority (NPDES); 35 States O&M manual review authority; and 29 States POTW construction plans and specification review authority.

The States provide, in their annual State programs, output commitments to be achieved for the forthcoming year. These serve as milestones for accomplishing the major water quality goals.

Output estimates and accomplishments for FY 1975 are presented in Table VI-I. Resources applied by the States to achieve the outputs are shown in Figure VI-I. Table VI-2 shows the Federal share and total amount of planned FY 1975 State program expenditures by State.

In addition to the Table VI-1 activities, during 1975 States were active in certification and drafting of permits; monitoring water quality; enforcement; and training programs. Planned and/or actual outputs were dependent in some cases on EPA actions (e.g., certification of permits based on EPA issuance); therefore, no comparable national achievement rate was measured. In other cases where no achievement rate is given, the States were not asked for commitments due to difficulty in establishing valid output measures and/or validly projecting a "planned" figure.

Moving to the New System.—Several factors affected the level of achievement of the planned outputs for FY75: guidelines from EPA were still being finalized well into the year; States in many case directed their limited resources to high priority areas which in turn reduced staff of lower priority programs (e.g., basin planning); vacancy rates were high in some States, particularly in the municipal facilities area, due partly to low salary

TABLE VI-1
FISCAL YEAR 1975 OUTPUTS*

Program area	Planned FY 75		Actual FY 75		Percent achieved
NPDES delegation	States	35	States	24	69
O&M manual delegation	States	40	States	35	88
P&S review delegation	States	38	States	29	76
WQL segment analyses	Analyses	2170	Analyses	1712	79
Basin plans completed	Basins	390	Basins	115	29
Major industrial permits issued by States		820		778	95
Minor industrial permits issued by States		11892		10804	91
Major municipal permits issued by States		875		782	89
Minor municipal permits issued by States		6169		5097	83
Construction grant awards ($billion)		6.5		3.6	55

*Figures obtained through EPA's Federal Planning and Reporting System and Grants Activity Report

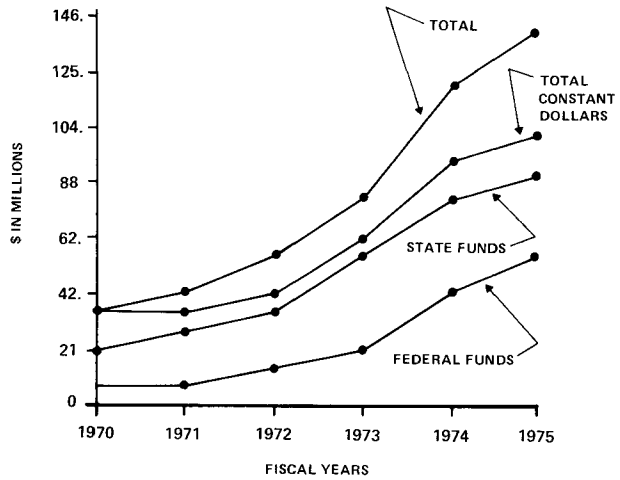
scales, and some areas lacked a clear-cut definition of EPA vs. State responsibilities (e.g., municipal facilities).

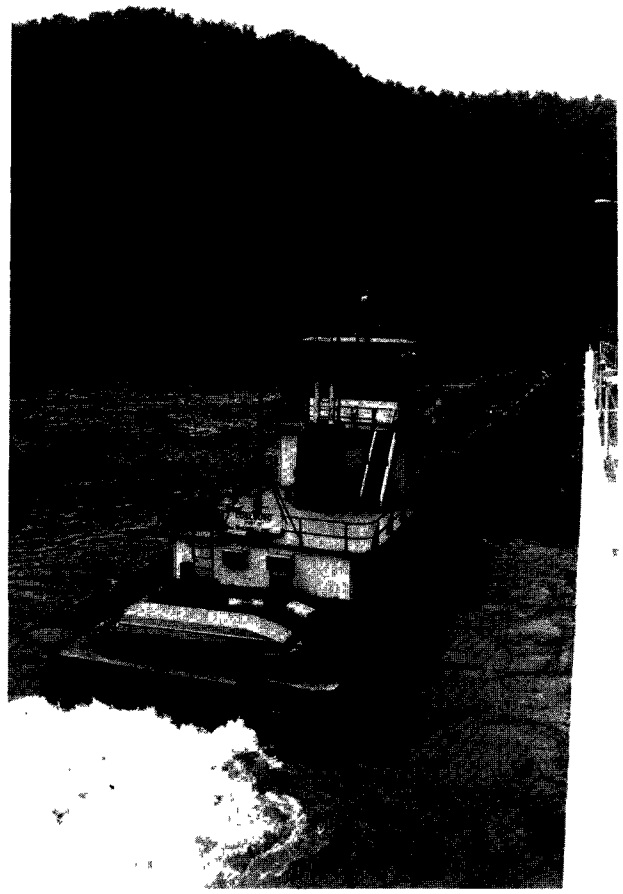
1975 did prove to be a productive year for the water program at the State level, relative to 1974. As it was the first full year of activity following passage of PL 92-500, 1974 was basically a transition year for the States as they became familiar with the new Federal/State program. 1975, however, showed expanded State activity and responsibility in carrying out the short-term goals and objectives of the program. Given limited resources and significant staffing problems, the States did a creditable job meeting output targets and working in partnership with EPA in several program areas.

State production increased significantly during FY75, and it was apparent that both EPA and the States has made most of the major adjustments required by P.L. 92-500 and the new regulations issued pursuant to the Act. Prospects for 1976 are generally good, except in the area of funding, where inflation and fiscal constraints on both EPA and the States threaten the attainment of the major milestones in the Act as well as the States' capability to play the role envisioned from them in the Act.

Figure VI-1.

FEDERAL-STATE EXPENDITURES AND CONSTANT DOLLARS





The nation's environmental and energy needs must both be met. *(Barges transport coal to Ohio River power plant.)*

TABLE VI-2
PLANNED FY 1975 FEDERAL-STATE TOTAL COMPARED TO FEDERAL CONTRIBUTION

State/Region	Total ($)	Federal contribution ($)	Federal share (%)
Region I			
Conn.	1912348	710298	37
Maine	1383827	146900	11
Mass.	1961126	951600	49
N.H.	1848800	271800	15
R.I.	570300	342300	60
Vt.	854656	198900	23
Region II			
N.J.	3508925	1137035	32
N.Y.	9072416	2203382	24
P.R.	1080548	651056	60
V.I.	446461	293155	66
Region III			
Del.	1324256	705213	53
D.C.	432622	270029	62
Md.	3060057	674616	22
Pa.	6204233	1790134	29
Va.	5125140	1006112	20
W. Va.	870760	430940	49
Region IV			
Ala.	1077128	931408	86
Fla.	4651323	1030718	22
Ga.	2053428	1246499	61
Ky.	1517259	588288	39
Miss.	1167378	595097	51
N.C.	2831253	1468797	52
S.C.	1943653	795947	41
Tenn.	1867072	795367	43
Region V			
Ill.	7415518	1499380	20
Ind.	2439903	1303143	53
Mich.	5049700	1933987	38
Minn.	2072614	749367	36
Ohio	5199489	1531484	29
Wis.	3371516	1085316	32
Region VI			
Ariz.	987289	593675	60
La.	1155812	686710	59
N.M.	525604	262931	50
Okla.	694626	442600	64
Tex.	6372210	1477400	23
Region VII			
Iowa	834851	661682	79
Kans.	1033211	421822	41
Mo.	1169406	755190	65
Nebr.	898367	502900	56
Region VIII			
Colo.	1153892	375242	33
Mont.	537120	317398	59
N. Dak.	275800	171530	62
S. Dak.	231700	173015	75
Wyo.	345730	127830	37
Utah	542665	246034	45
Region IX			
Ariz.	631976	325900	52
Calif.	11025400	2355848	21
Guam	339899	248868	73
Hawaii	649001	283263	44
Nev.	309782	139923	45
American Samoa	151329	62228	41
Trust Territories	183040	134887	74
Region X			
Alas.	260378	131039	50
Idaho	741618	347522	47
Oreg.	1609218	667700	41
Wash.	1787286	872500	49

National Total = $112,574,919
Federal contribution = $40,123,905
Federal share = 36%

Statewide Planning and Management

EPA, together with the States and numerous advisors, have labored to flesh out the specific planning mandates of the Act to form a meaningful State management tool. The goal has been to translate preexisting State efforts into a workable new program in keeping with the 1972 Amendments. The continuing planning process (section 303(e)) is the vehicle which integrates the various related elements of the Act—Statewide, areawide, local and facilities oriented activities—and acts as the State's central management tool for administering water quality programs. As of December 31, 1975, all 56 States and territories had an EPA-approved continuing planning process. These will be revised during 1976 in accordance with revised regulations (40 CFR 130) promulgated November 28, 1975.

A Two-phased Program.—Statewide planning involves essentially two phases. The first phase, basin planning, accomplishes the transition from pre-amendment planning into the more sophisticated effort contemplated by the new Act. This phase, scheduled for completion by July 1, 1976, encompasses the following requirements:

1. Inventory and ranking of significant dischargers.
2. Schedule of compliance or target dates.
3. Assessment of municipal needs.
4. Determination of total maximum daily loads.
5. Established or targeted load allocations and effluent limitations.
6. Assessment of nonpoint sources of pollution.
7. Residual waste controls.
8. Recommended water quality standards revisions.
9. Planning relationships.
10. Appropriate monitoring and surveillance programs.
11. Interstate/intergovernmental cooperation.

Phase II, termed State Water Quality Management Planning, will fold the State's more complex areawide planning efforts (see section 208) into the completed Phase I basin plans. Essential management activities—establishing priorities, scheduling actions and assisting the direction of resource expenditures—operate in both phases.

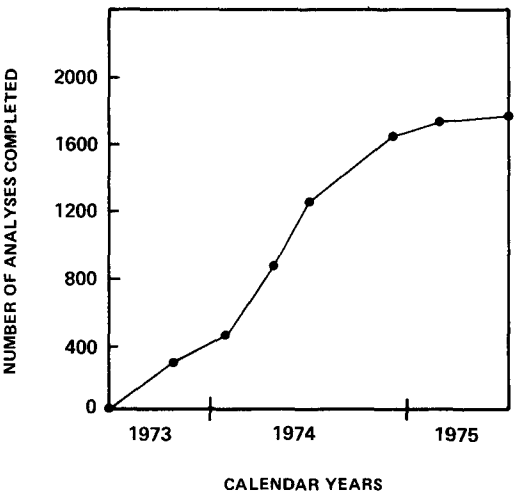
The major change in Phase II will be the addition of nonpoint source control programs. Phase I has provided preliminary qualitative evaluation of the nature and extent of nonpoint source loading, but Phase II plans should present a far more detailed evaluation of these loadings and identify control measures, regulatory programs and implementing agencies. The Phase II process will also produce information on urban stormwater systems, industrial waste treatment needs, and residual waste controls. A Federal district court has ruled that Phase II plans, including section 208 requirements, must be completed no later than November 1978.

The Early Results.—Although transition from Phase I to Phase II is now in progress, specific priority items are already completed and in use. Significantly, a majority of total maximum daily load determinations and wasteload allocations are now available for use in setting the effluent limits in NPDES permits.

According to EPA's formal reporting system, 1,712 water quality segment analyses, out of a total 2,362 such segments, had been completed as of June 30, 1975. Figure VI-2 shows the progress toward completing the analyses for all water quality segments. Of those that do not yet have completed water quality segment analyses, most include significant nonpoint source control problem areas (which will be further developed under Phase II planning) or extremely complex urban/industrial areas which demand more detailed analysis.

Figure VI-2.

NUMBER OF WATER QUALITY SEGMENT ANALYSES



Overall, the Statewide planning programs appear to be functioning at a passable level. As could be expected, there have been many growing pains associated with the developmental stages of the program. Recent indications are, however, that the program is functioning as a necessary and viable part of the effort to clean our nation's waters.

Areawide Planning and Management

The Act provides local areas with a unique opportunity to plan and manage a comprehensive waste treatment control program for municipal and industrial wastewater; storm and combined sewer runoff, nonpoint source pollutants and land use as it relates to water quality. This areawide planning and management program concentrates on metropolitan areas that have water quality

problems requiring treatment levels beyond secondary for municipal wastes and best practicable control technology for industrial wastes. It may also involve areas that wish to preserve high quality waters or that have been or will be subject to extensive energy development.

Beginning the Effort.—Initiation of the program lagged somewhat because of the attention demanded by the permit program, construction grants and Statewide planning. During 1974, however, this program was launched. Regulations published September 14, 1973, and revised November 28, 1975, set forth specific criteria for area and planning agency designation. They include:

- Areas—a preference for areas with urban-industrial concentrations or with substantial surface and/or ground water quality problems; and
- Agencies—an insistance that agencies possess a coordinated waste treatment management system or that the local governments intend to plan and implement areawide waste treatment management.

Generally, the State Governor designates the areas as well as the agencies that will conduct the work. He is responsible for assuring that the work is completed and is consistent with the overall State effort. In areas which are not designated pursuant to section 208, the State's water quality management plans and individual facility plans will provide programs addressing the needs of the area.

Most of the agencies approved are general purpose regional planning agencies representing urban-industrial areas. Some agencies, in contrast, will work in areas with substantial ground water pollution problems, such as Nassau-Suffolk, New York, other agencies will work in areas that are subject to extensive energy development, such as the Yellowstone-Tongue area of Wyoming, or areas seeking to preserve existing high quality waters, such as Jackson Hole, Wyoming. The average 208 area contains 2,490 square miles and has a population of 610,000.

Implementing the Plan—The areawide planning agencies will develop comprehensive plans covering both point and nonpoint sources of pollution. An essential ingredient of any plan is a management system to insure plan implementation.

The primary importance of the agencies will be realized when plans are carried out during 1977-83—Phase II of the national water quality control effort. At that time, permits in areawide planning areas should begin to reflect plan targets and directives.

However, planners must also show an ability to produce usable interim outputs. These can be significant early achievements of the plan and can contribute to near-term State areawide discussion and coordination as well as to specific management actions.

Progress to Date

A few agency designations were made in FY 74, with fourteen area and agency designations and eleven grant awards, totalling approximately $13.5 million. However, FY 75 has marked the real growth of the program, with the additon of 138 grants at $150 million bringing the total to 149 grants amounting to $163.5 million. (see Table VI-3.)

By early June, 1975, applications nationwide for grants totalled over $176 million. However, EPA was only authorized to obligate $150 million for Fiscal Year 1975. This resulted in 23 designations submitted by Governors but not approved due to lack of funds. The system for awarding 208 grants was modified at the beginning of April 1975 by means of funding allocations to each of EPA's ten regions. From that point it was carried on a national first-come, first-served basis.

ASSOCIATED PLANNING

Other planning efforts are authorized by the Act. These include comprehensive planning for water pollution control (Section 102) and Water Resources Council basin planning of water resources (section 209).

The 102(c) program was designed essentially as a continuation of the 3(c) program established under prior water quality legislation. Since passage of the 1972 Amendments to the law there have been no new funding allocations authorized in either the 3(c) program or the 102(c) program.

This year's budget request submitted by the President included, for the first time, a proposal for a Level B Water Resources Study to be funded under the authority of section 209 of the Act. Previous Level B efforts have been funded under other authorities.

TABLE VI-3
SECTION 208
DESIGNATIONS APPROVED BY ADMINISTRATOR
BY STATE
DECEMBER 31, 1975
Designation

Region	State	Area	Date
IV	*Alabama*	Birmingham	3-25-75
		Tuscaloosa	3-25-75
		Mobile	5-22-75
IX	*Arizona*	Tucson	6-06-75
IX	*California*	Lake Tahoe (Interstate.)	8-05-74
		Ventura Co.	6-13-75
		San Diego	6-18-75
		Monterey	6-18-75
		San Francisco	6-18-75
VIII	*Colorado*	Denver	10-08-74
		Pueblo County	9-18-74
		Colorado Springs	6-26-74
		Rifle (Rio Blanco)	4-24-75
		Northwest	5-14-74
		Larimer-Weld	5-14-75
III	*Delaware*	New Castle County	6-12-74
		Sussex County	1-30-75
III	*District of Columbia*	Washington-Metro Area	3-28-75
IV	*Florida*	Palm Beach	1-10-75
		Orlando	3-28-75
		Volusia Co.	4-22-75
		Brevard Co.	4-24-75
		Bay Co.	4-30-75
		Pensacola	5-14-75
		Sarasota/Ft. Myers	5-16-75
		Broward Co.	5-23-75
		Tampa Bay	5-27-75
		Dade Co.	5-30-75
		Tallahassee	5-30-75
		Polk Co.	6-06-75
XI	*Guam*		6-18-75
X	*Idaho*	Boise	4-02-75
		Pocatello	3-25-75
		Panhandle	5-27-75
V	*Illinois*	Chicago	5-30-75
		East St. Louis	5-20-75
		Southern	6-23-75
V	*Indiana*	Lake & Porter Co.	5-20-75
		South Bend	5-23-75
		Madison-Muncie	5-27-75
		Indianapolis	5-30-75
		Terre Haute	6-06-75
VII	*Iowa*	Des Moines	6-10-74
		Centerville	5-23-75
VII	*Kansas*	Kansas City	6-13-75
IV	*Kentucky*	Louisville	4-02-75
I	*Maine*	Portland	6-25-74
		Southern Maine	7-26-74
		Northern Maine	8-05-74
		Lewiston-Auburn	12-19-74
		Augusta-Cobbossee	12-19-74
III	*Maryland*	Baltimore	6-06-75
I	*Massachusetts*	Pittsfield (Berkshire)	2-18-75
		Lowell	3-04-75
		Cape Cod	2-27-75
		Martha's Vineyard	2-27-75
		Brockton	3-06-75
		Worcester	4-11-75
		Fitchburg	4-17-75
		Boston	4-18-75
		Southeast	5-20-75
V	*Michigan*	Detroit	5-20-75
		Kalamazoo	5-27-75
		Jackson	5-27-75
		Flint	5-27-75
		Tri County	6-06-75
		Muskegon	6-06-75
		Grand Rapids	6-06-75
		Bay City	6-06-75
VII	*Missouri*	St. Louis	5-23-75
		Joplin	6-06-75
VIII	*Montana*	Middle Yellowstone	4-02-75
		Yellowstone	
		Tongue	4-08-75
		Flathead	4-02-75
		Gallatin	6-05-75
IX	*Nevada*	Carson River	6-03-75
		Reno	6-06-75
		Clark Co.	6-13-75
I	*New Hampshire*	Salem	4-01-75
		Lakes Region	6-03-75

TABLE VI-3
SECTION 208
DESIGNATIONS APPROVED BY ADMINISTRATOR
BY STATE
DECEMBER 31, 1975
(Continued)

Region	State	Area	Date
II	*New Jersey*	Mercer	5-12-75
		Middlesex	5-14-75
	New Jersey	Camden	5-14-75
		Ocean Co.	6-03-75
II	*New York*	Nassau-Suffolk	4-24-75
		Westchester	6-03-75
		Erie-Niagara	6-03-75
		So. Tier Cen. (Corning)	6-05-75
		New York City	6-05-75
		Central NY (Syracuse)	6-05-75
IV	*North Carolina*	Raleigh-Durham	3-08-74
		Asheville	6-23-75
VIII	*N. Dakota*	Lewis & Clark	5-22-75
V	*Ohio*	Cincinnati	6-12-74
		Toledo	6-25-74
		Youngstown	6-28-75
		Dayton	6-25-74
		Cleveland	5-27-75
		Akron	5-23-75
VI	*Oklahoma*	Tulsa	9-18-74
		Oklahoma City	10-25-74
X	*Oregon*	Portland	11-18-74
		Salem	11-18-74
		Eugene-Springfield	11-18-74
		Medford	6-03-75
III	*Pennsylvania*	Philadelphia	6-18-75
		Pittsburgh	6-23-75
I	*Rhode Island*	Providence	6-23-75
II	*Puerto Rico*	San Juan	4-17-75
IV	*South Carolina*	Columbia	3-25-75
		Greenville	5-09-75
		Beaufort	6-03-75
		Charleston	6-06-75
		Waccamaw	6-06-75
VIII	*S. Dakota*	Sioux Falls	5-23-75
		Black Hills	5-16-75
IV	*Tennessee*	Memphis	6-25-75
		Knoxville	6-28-74
		Chattanooga	10-10-74
		Nashville	11-11-75
		Kingsport-Bristol	6-05-75
VI	*Texas*	Dallas	4-17-75
		Beaumont	4-18-75
		Houston	4-22-75
		San Antonio	5-10-75
		Corpus Christi	6-06-75
		Lower Rio Grande	6-06-75
		Texarkana	6-23-75
VIII	*Utah*	Provo	1-21-75
		Uintah Basin	1-10-75
		Salt Lake County	3-06-75
		Ogden (Weber-Davis Cos.)	4-02-75
		Southeastern	4-17-75
		Five Counties	5-14-75
III	*Virginia*	Hampton Roads	6-25-74
		Richmond	6-25-74
		Roanoke	6-25-74
		Fredericksburg	1-07-75
		Southwest Va.	1-30-75
X	*Washington*	Clark County	4-09-75
		Seattle	4-20-75
		Snohomish	6-03-75
III	*West Virginia*	Charleston	6-06-75
V	*Wisconsin*	Southeastern Area	12-26-74
		Dane County	5-22-75
		Green Bay	6-06-75
VIII	*Wyoming*	Powder River	4-04-75
		Green River	5-14-75
		Jackson Hole	6-04-75

Nonpoint Source Program

The Evolving Nonpoint Source Strategy

The legal mandate to protect water quality from nonpoint source impacts is far more tenuous than the Act's point source control provisions. Perplexing technical problems confront this, as any, area of pollution control. Furthermore, sound regulatory moves to abate nonpoint source problems may raise the red flag of Federal land use control. Nonetheless, as Congress recognized in passing section 208, the national water quality effort can never succeed by addressing point sources alone.

Until 1974, EPA did not emphasize nonpoint sources management, but rather concentrated limited Federal and other resources on initiating point source controls. Now that the first round of NPDES permits is virtually complete, the Agency as a part of its long term program plan is urging the States and planning agencies designated under section 208 to begin problem assessment and planning nonpoint source management. Under the Act, designated 208 planning agencies and, in their absence, the States are expressly responsible for assessing nonpoint source control needs and designing programs for pollution abatement. These efforts will be integral parts of the areawide planning and State water quality management processes. (See Chapter VI.)

Some States are not only far along in the assessment and planning stages of their programs, but have passed legislation and are in the process of implementing regulatory programs to control certain categories of nonpoint sources. Whether a program has been initiated or not, EPA is encouraging each State and local designated 208 agency to move forward as rapidly as resources allow.

EPA issued regulations for State programs in nondesignated areas in November, 1975 and is in the process of developing guidelines, which will be published during 1976. In addition, the Agency will assist States and 208 agencies by providing technical guidance manuals dealing with specific nonpoint sources and the activities which cause them. The States and local agencies will be encouraged to incorporate EPA's approach into their programs.

EPA is also working closely with Federal agencies that manage lands or impact land managing activities. The goal is to achieve a coordinated Federal/State/local approach to nonpoint source problems.

Best Management Practices.—Severe technical difficulties impede precise identification and measurement of individual nonpoint source impacts. EPA believes that sound land management practices, rather than after-the-fact treatment, may best abate this type of pollution. EPA's guidance therefore concentrates on describing preventative measures, termed Best Management Practices ("BMPs").

The term "Best Management Practice" refers to a practice or combination of practices that is determined by a State after problem assessment, examination of alternatives, and appropriate public participation to be practicable and most effective in preventing or reducing the amount of pollution generated by diffuse sources to a level compatible with water quality goals.

Best Management Practices will be designated to prevent or mitigate pollution normally associated with such land-disturbing activities as agriculture, silviculture, and construction. Each BMP will be tailored to the type of activity as well as the prevailing physical factors at the source such as slope, soil, rainfall, climate and vegetative cover. These variables will to a great extent determine which control methods pertain in any area.

New and existing sources may be handled differently within a State or area. For a new land-disturbing activity there are often more options for highly effective management measures. These more stringent practices will be considered in State selection of BMP's for new sources.

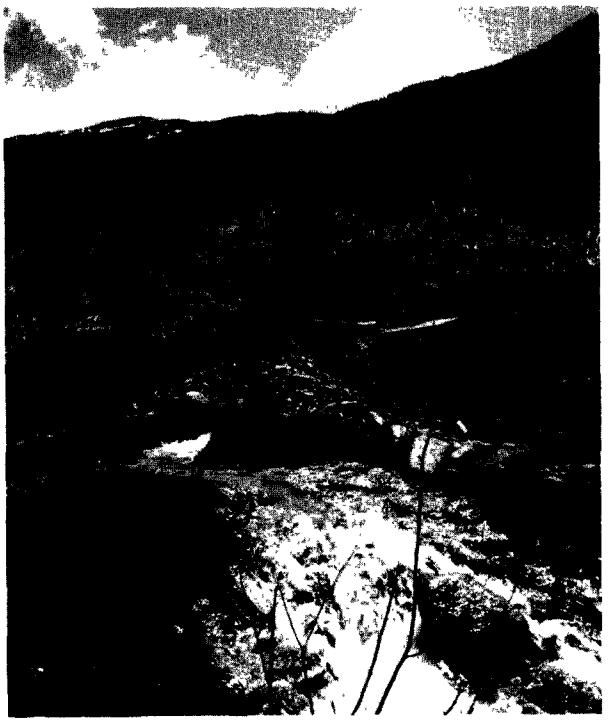
UNRESOLVED ISSUES AND PROBLEM AREAS

Administrative Obstacles.—A variety of administrative obstacles confront the fledgling national nonpoint source program. First, a Federal district court has recently maintained that EPA may no longer exclude any point sources from the NPDES permit program. Under this ruling, permit program regulatory responsibilities are being redefined in new regulations relating to feedlots, storm sewers, irrigation return flows, and silviculture. In the past, EPA claimed authority to exempt these categories of sources from the permit program and to deal with them as if they were all nonpoint sources.

In the past, Federal financial support for Statewide 208 planning has not been available. A recent Federal district court decision has ordered that section 208 designated area funds be made available for State planning. Funds have been made available for States in FY76.

Technological Problems.—Across the country, the state of the art in respect to prediction and assessment of nonpoint sources lags considerably behind our understanding of the magnitude of the problems and the need for prevention or control. The best management practices approach has been determined to be the most practical means of assigning control responsibilities, but the BMP/resulting-effects equation is at times uncertain. For a number of land management practices, predictive techniques allow estimates of the expected reduction of particular pollutants. However, nonpoint source managers are often denied assurance, usually available in point source effluent control technology, that the result will match the expectation.

Difficult as it is to predict the pollutant loading that might result from a single nonpoint source activity, it is more difficult to succeed in tracing instream pollutants back to specific sites. Where a large number of nonpoint sources operate side by side, the problem is compounded.



Acid mine drainage degrades streams once depended upon for sport fishing and municipal drinking waters. *(Mine near Rico, Colo.)*

Significant nonpoint sources will be required to employ best management practices to minimize their pollution effects. *(Holding pond near Uravan, Colo.)*

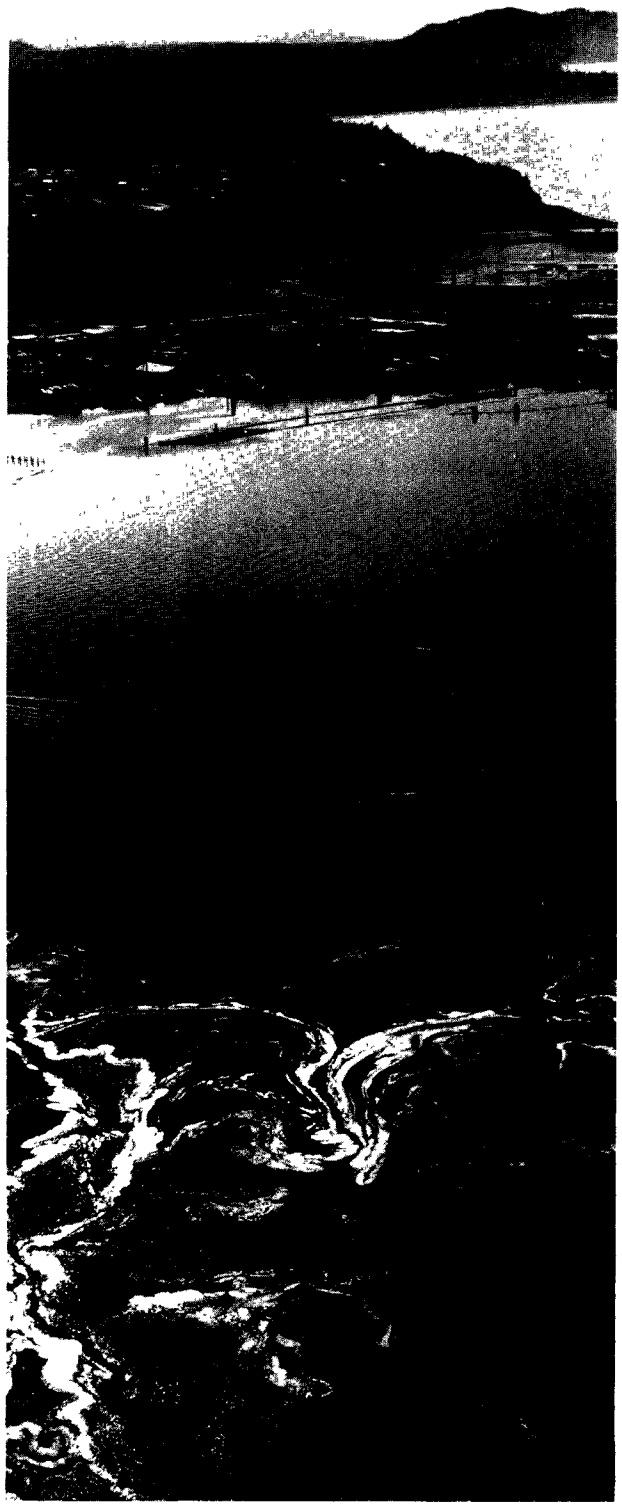
An efficient nonpoint source program should be limited to control of significant sources. However, technically, and ultimately administratively, it is difficult to determine a uniform cut-off point at which a substance will begin to cause in-stream damage and should be cited as significant.

In applying solutions such as Best Management Practices to nonpoint source pollution, water quality management officials must often rely on insufficient information. Gaps may result from a lack of necessary research, from the inherent complexities of the pollution problem, or—most likely—from both. For example, control of acid mine drainage from abandoned mines is extremely difficult, as it is too late for preventative management practices. While perhaps one half of the drainage problems could be corrected with sufficient funds, the solutions to the remainder are unknown.

For other complex nonpoint sources, technological solutions may be perceived but not proved. Full scale use of promising techniques cannot be advocated until after adequate testing.

Administrative Problems at the State Level.—Even given technical answers to a State's nonpoint source pollution problems, existing laws, traditions, and State and local politics will often prove serious obstacles to their implementation. It is not clear how these problems can be overcome, particularly in the absence of adequate sanctions.

Finally, the nonpoint source program bluntly faces the Act's ever present deadline problem. Success should be achieved by 1983—but before that, a number of sequential efforts are necessary. In many States, legislation must be passed; institutions must be established or redirected; regulatory measures must be defined and applied; and individual nonpoint source managers must implement their responsibilities. For some States to accept and carry out these comprehensive tasks may take many years. In such States, it is unlikely that the 1983 goals can be achieved for all waters.



Excessive pulping wastes interfere with aquatic life by depleting the water's oxygen and adding excessive nutrients and, in some cases, toxic chemicals. *(Foamy pulping waste, Port Angeles, Wash.)*

Research and Development

INTRODUCTION

A strong scientific and technical base is crucial to EPA's success in formulating policy, setting standards, implementing programs and pursuing necessary enforcement. The Agency is conducting a research, development, and demonstration program focussed on developing new or improved pollution control technology, improving monitoring instrumentation and methods, increasing understanding of pollution processes and their effects on public health and aquatic ecosytems, developing more effective methods to utilize scientific, technical, and socio-economic data for environmental decision-making. Together, these interrelated programs provide technical support to EPA and other agencies responsible for improving the Nation's waters.

This chapter outlines the actions taken and results achieved during 1974 and 1975 in EPA's research, development, and demonstration programs.

HEALTH EFFECTS PROGRAM

The health effects program concentrates on two major activities: assessing the effects of water pollutants on health, and developing criteria and standards to ensure safe supplies of drinking water.

Health Effects.—The water quality health effects research and development program embodies: (1) health effects research dealing with the development of valid criteria for the safe treatment and disposal of wastewaters and sludges and (2) the development of health-related criteria for fresh and marine recreational and shellfish growing waters.

Studies are being conducted on the health effects of land application of wastewaters and sludges and on the transport of toxic substances and pathogens (especially virus) from wastewater and sludge to man's food chain and drinking water. Such studies require extensive monitoring of waste components and waste breakdown products in water, food, and air.

At present, under the *fresh recreational water program,* the etiology of amoebic meningoencephalitis is being investigated. Broad epidemiologic-microbiological studies will be initiated to refine fresh recreational water quality criteria based on scientific health effects data.

The *marine recreational water program* deals with epidemiological studies of marine beaches in temperate climates. It may be extended to tropical climates as well during FY 1977. Epidemiologic-microbiological studies are being conducted in recreational waters to relate health effects to various quantitative indices of pollution. Moreover, modest research programs will be initiated to improve microbial water quality guidelines for marine shellfish-growing waters.

Recent accomplishments include the following:

- Studies have been initiated to determine aerosol transport from conventional wastewater treatment plants. In addition, the transport of microbiological contaminants and chemical compounds from spray irrigation of wastewater and sludge application to land will be determined. Pathogen transport through sludge application to land will be investigated.
- Statistically significant differences were identified between the illness rates at two marine beaches—one of barely acceptable water quality, the other relatively unpolluted. An additional pair of beaches in the vicinity of New York City will be investigated during the 1976 swimming season.

- Attempts are being made to determine the frequency, distribution and cause of amoebic meningoencephalitis. This almost invariably fatal disease is believed to strike following swimmming in fresh or brackish waters.

Water Supply Research.—Funding for the Water Supply Research Program is provided under the Safe Drinking Water Act of 1974. Since these activities are related to those of the FWPC Act, they are included here for the sake of completeness.

The objective of the Water Supply Research Program is to provide the scientific knowledge necessary to refine standards for organic, inorganic, and microbiological contaminants of drinking water. These standards will then be incorporated into primary drinking water regulations under the Safe Drinking Water Act of 1974. Treatment processes for the removal and/or inactivation of contaminants are being developed, as are control techniques to protect water supplies at the source and in the distribution system.

Major research activities include:

- Nationwide surveys to determine the extent of contamination of water supplies by viruses, organic and inorganic chemicals—especially those suspected of having carcinogenic properties.
- The isolation and identification of organic compounds present in drinking water. Toxicological studies are being carried out on organic residues isolated from tap water by reverse osmosis techniques. Results of toxicological studies will assist in the design of corroborative epidemiological studies.
- Studies to establish criteria based on health effects for the inorganic chemical contaminants of drinking water.
- Investigation of occurrence of water-borne diseases. The objective is to determine what diseases are or may be transmitted by drinking water, and the conditions that allow this to occur. This knowledge will indicate what improvements in technology or operating practices are needed by the water-works industry.
- Development and evaluation of various water-treatment processes for the removal of trace organics and taste- and odor- producing substances. Current work involves the use of activated carbon and oxidants such as ozone for the removal process.
- Evaluation and improvement of methods for the inactivation of microorganisms in drinking water. Studies are being conducted on the interference of turbidity with the disinfection process and on the chlorine-resistance of naturally occuring viruses.
- Evaluation of water-treatment processes for the removal of a variety of inorganic contaminants (arsenic, asbestos, barium, cadmium, chromium, lead, mercury, selenium, radium). Studies of the chemical and bacteriological water-quality deterioration that can occur during storage and distribution of drinking water. Methods are being developed to monitor the quality of water in the distribution system and to minimize any such deterioration in quality.
- Determination of the amounts of asbestos and vinyl chloride leached respectively from asbestos-cement and PVC pipes.

Recent *accomplishments* include the following:

- A review was made of the incidence during the last decade of water-borne disease outbreaks. Causes of outbreaks were investigated so that the deficiences in water-supply systems and operation practices can be corrected, thus preventing the recurrence of such outbreaks.
- The first phase of the nationwide drinking water survey has been completed.
- A breakthrough in virus quantification.
- A new sampling device, the "mini-sampler," has been devised for capture of total organics on activated carbon.
- A water quality monitor has been developed, through contract, to measure physical properties as well as to detect trace metals at low concentrations. Measurements include copper, cadmium, lead, flouride, nitrate, chloride, residual chlorine, turbidity, temperature, dissolved oxygen, pH, conductivity, hardness, alkalinity, and corrosion potential. Arsenic has been shown to be removable from water supplies by coagulation with ferric sulfate. Removals in excess of 95 percent can be achieved.
- Reverse osmosis has been analyzed as a potential mechanism for the concentration of organics from drinking water and appears to be promising.
- The use of cell cultures as test organisms has been demonstrated to be a valuable rapid

technique to determine the toxicity of inorganics and organics found in drinking water.

ECOLOGICAL PROCESSES AND EFFECTS PROGRAMS

Ecological studies are directed primarily toward development of criteria to be used in setting water quality standards. Two major study areas are estuaries and the Great Lakes.

Marine and Estuarine Research.—The objectives of the marine and estuarine research program include developing (1) scientifically and legally defensible water quality criteria; (2) information for assessment of damage to marine ecosystems from acute and chronic exposures to pollutants; (3) criteria for ocean disposal of pollutants on marine ecosystems.

The following studies were initiated or continued in 1974 in response to section 104:

- Description of pollution stress in arctic and sub-arctic estuarine ecosystems.
- Ecological impact of petroleum substances, heavy metals, and synthetic organic compounds on coastal ecosystems.
- Ecological requirements essential for the protection of estuarine ecosystems.
- Development of biological response models indicating the reaction of estuarine ecosystems to pollutional stress.
- Ecological impact of ocean waste outfalls and ocean dumping activities.
- Ecological impact of chlorinated effluents from sewage treatment plants and chlorinated power plant cooling waters.

Freshwater Ecological Research.—EPA's freshwater ecological research program at present is focused on five principal areas: (1) effects of pollutants or other stresses on aquatic organisms, including the determination of environmental requirements and limits; (2) the source, transport, transformation, ultimate fate, and ecosystem-level effects of pollutants in freshwater ecosystems generally and in the Great Lakes specifically, including the impact of water quality control measures; (3) the eutrophication of lakes, methods for evaluating the trophic status of natural waters, and methods for reversing or redirecting the undesirable effects of cultural eutrophication; (4) the effects of man-induced stresses on arctic ecosystems as screening tools for toxic substances and as standardized systems for indicating potential ecosystem-level effects. All of these activities have either evolved in response to Agency needs for a data base upon which to develop water quality criteria and standards, or have been initiated in direct response to section 104.

Recent accomplishments in freshwater ecological research include the following:

- Developed freshwater aquatic life criteria for chlorine and chlorination products produced by the use of chlorine in the sterilization of sewage effluents and as an antifoulant in condenser cleaning for power generating stations. These data have helped identify potential problems regarding disinfection of wastes.
- Developed the test procedures and protocol for biologically testing freshwater organisms for toxicity of new chemicals. These procedures are being incorporated into registration requirements for pesticide and other toxic substances.
- Developed data used by the Agency to establish criteria for many elements and compounds including PCB's, heavy metals, pesticides, ammonia, hydrogen cyanide, hydrogen sulfide, temperature, oxygen requirements and many other organic and/or inorganic chemicals.
- Assisted various local, State, Federal, and international agencies in the development and review of proposed regulations relating to water quality and effluent standards.
- Developed fluid dynamic plume models of thermal discharge. These models have been used by EPA throughout the nation in court actions involving application of the provisions of S. 316(a) of P.L. 92-500.
- Demonstrated applicability of advanced waste treatment as a lake restoration technique. This finding substantiates Agency policy that eutrophication may be controlled on an individual case basis and that nationwide curatives, such as banning phosphates from detergents, are not required.

Great Lakes Research.—EPA's research program on the Great Lakes provides a scientific basis for assessing the source, fate, effects, and importance of pollutants in large lakes in general, with particular emphasis on the Great Lakes. As an integral part of this program, predictive mathematical models for lake water quality management are being developed and improved.

EPA's research program includes studies of ecological processes and effects. *(Dead carp floating in algae, Wisconsin.)*

Among the specific pollution problems being addressed are:

- Eutrophication (or nutrient enrichment) and its effects.
- Thermal pollution and related problems associated with power production.
- Hazardous materials source, fate, and effects.
- Disposal of dredging spoils, and ecological effects on wetlands of shoreline construction, canal digging, road construction, and hydrologic modifications.

As an outgrowth of the International Field Year for the Great Lakes (IFYGL) program, a working mathematical model of Lake Ontario is now operational and is being tested. Work is under way to develop similar mathematical models of Lakes Erie and Huron so that within approximately one year there will be available a 3-lake system of predictive models capable of simulating not only eutrophication effects within each lake, but also interactions between lakes.

In support of the above predictive development and of the International Joint Commission (IJC) Upper Great Lakes Reference Study, field research continued in Saginaw Bay and southern Lake Huron.

MUNICIPAL POLLUTION CONTROL

Sludge Program.—With improvement of the quality of wastewater treatment, sludge processing, utilization, and disposal has become a greater problem. Utilization of sludges for beneficial purposes has also received new emphasis, due to the potential value of the material as a soil conditioner, low-grade fertilizer and as an alternative energy source.

As more municipalities upgrade facilities to improve effluent quality, the quantity of sludge will continue to increase. Table VIII-1 compares sludge production in 1972 with the estimated production in 1985. The amount of secondary sludge will be almost doubled, and chemical sludges will be produced in far greater quantities. Processing costs will increase more than proportionally because the biological secondary sludges and several types of chemical sludges are unusually difficult to dewater.

TABLE VIII-1

TRENDS IN PRODUCTION AND DISPOSAL OF MUNICIPAL WASTEWATER SLUDGE IN THE U.S.

	1972		1985	
Sludge type	Popul. (mill.)	Dry tons** per year	Popul (mill)	Dry tons per year
Primary (0.12 lb/cap-day)*	145	3,170,000	170	3,720,000
Secondary (0.08 lb/cap-day) ...	101	1,480,000	170	2,480,000
Chemical (0.05 lb/cap-day)	10	91,000	50	455,000
Disposal methods		Percent		Percent
Landfill		40		40
Utilized on land		20		25
Incineration		25		35
Ocean (Dumping and outfalls)		15		0

* lb × 0 454 = kg

** ton × 0 908 = metric ton

Reference "Overview of Sludge Handling and Disposal", J. B. Farrell, National Conference on Municipal Sludge Management, June, 1974

One of the primary objectives of the municipal pollution control research, development, and demonstration program is to advance the technology for processing, utilization and disposal of the sludges resulting from wastewater treatment and to improve the cost factors associated with application of the technology.

The early thrust of the research program examined the physical problems and costs of dewatering sludges, since dewatering capability is critical

to final disposition. Moisture content, for example, must be minimized for sludges destined for incineration in order to keep energy requirements and costs as low as possible.

Direction of the program is now toward the application of technologies which offer new potential for formulating and applying sludge management systems in a cost/effective manner, including full consideration of environmental acceptability.

Beginning in 1974 and for the immediate future, the program is focusing on the development and demonstration of pyrolysis, co-incineration with municipal solid waste, and wet-oxidation. These methods will require little or no supplemental fuel; will produce usable fuel gas and char; and will eliminate the microbiological problems associated with municipal sludge, such as bacteria, virus, and intestinal parasites. Certain methods, such as wet-oxidation, offer the potential of reclamation of trace metals, and all offer the potential for utilization of waste heat for a variety of beneficial purposes.

A major effort is also being conducted to obtain the necessary data for the development of guidelines for the application of sludge to land. With the increase in the cost of fertilizer the use of sludge as a soil conditioner/fertilizer is receiving renewed interest. Municipalities are interested in more cost-effective methods of final disposal of the wastewater sludges. However, potential health hazards related to the microbiological and heavy metal constituents in sludge have been identified. Consequently, present efforts are being directed to the collection of information from existing systems, evaluation of new full-scale facilities utilizing the newest technology, and basic research studies.

Wastewater Disposal.—A second area within the Municipal Pollution Control program receiving increased attention is the land application of municipal wastewater.

The disposal of municipal wastewater to the land has been practiced around the world for centuries. In the United States, the practice began in about the late nineteenth century. The objective of most such systems, until recent years, was simply to dispose of a community's wastewater. Little consideration was given to treatment efficiency, environmental consequences, or reuse potentials.

The past few years have witnessed a renewed interest in land treatment of wastewaters. Factors accounting for the trend include concern for reuse of water and nutrients and for more ecologically compatible waste management, emphasis on energy and resources conservation, and a search for more cost-effective waste treatment systems.

The 1972 Amendments to the FWPC Act recognized land treatment of municipal wastewaters as a viable alternative for best practicable waste treatment. A major portion of the municipal pollution control research and development effort has therefore been devoted to developing the data base required for the design and successful operation of land treatment systems to help attain our national goal of protecting our environment through effective wastewater management.

To achieve these objectives, present efforts are directed to:

- Collecting information from existing systems to help predict long-term effects.
- Conducting full-scale evaluation projects to establish system operation and cost data.
- Conducting research to develop the technology of the three basic modes of land treatment.
- Conducting basic studies to ascertain the implications of land treatment related to unknown factors such as health effects, long-term effects on the soil, and other environmental consequences.

Some major land treatment demonstration and development projects currently funded by the Soil Treatment Systems Program are listed in Table VIII-2.

TABLE VIII-2
MAJOR SOIL TREATMENT SYSTEMS EVALUATION PROJECTS

Location	Type of system	Expected completion
Muskegon County, Mich.	Irrigation	12/31/77
Belding, Mich	Irrigation	04/01/77
Tallahassee, Fla.	Irrigation	12/12/75
Phoenix, Ariz.	Infiltration-Percolation	08/31/77
Lake George, N.Y.	Infiltration-Percolation	10/31/76
Pauls Valley, Okla.	Overland-Flow	06/15/76
El Paso, Tex.	Overland-Flow	06/31/75
Thayne, Wyo.	Irrigation	04/30/80
Barnstable County, Mass.	Infiltration-Percolation and Irrigation	06/10/76

INDUSTRIAL POLLUTION CONTROL

Point source discharges of water pollutants are primarily from the manufacturing industry. Based on water use and pollution loads, U.S. industry accounts for up to 60% of the use of the nation's water and also discharges a like percentage of the man-made pollution load to our streams. In addition to volume and discharge loads, the industrial water problem is complicated by the physical and chemical complexity of the wastes discharged, the extremely diverse characteristics of industrial classification, and a growth rate of about four times that of the population.

The Research and Development program, continuing in 1974, is primarily oriented toward establishing a technical basis for best available technology (BAT) regulations for industry. By law, the requirements are based on economic achievability. (See Chapter II.)

EPA's industrial research, development and demonstration program is directed toward innovative, efficient, and economical methods to control the pollution from industrial sources. This program provides:

- Demonstration technologies to verify the achievability of BAT for industrial wastewater treatment.
- An expanding data base for establishment of technically and economically feasible effluent guidelines.
- Definition of pretreatment parameters for discharge of industrial wastes to sewer systems.
- Alternative methods for control of pollutants, including process modification or reuse of water, waste heat, and residual materials.

In 1974, alleged inconsistencies and questionable technical-economic achievability of some of the new standards came under judicial review. As these problems are ironed out and the standards become established, the Agency will have utilized all the current storehouse of technology upon which the regulations must be based. EPA's R&D efforts in this area must therefore proceed with the development of new technologies. This effort will be a continuing development process to refine existing technology as well as seeking completely new solutions.

The EPA industrial R&D program results to date, in combination with on-the-shelf practiced technology, have provided the primary basis for all the promulgated regulations. Current projections indicate a strong EPA R&D technology role will be a necessity to move the regulations toward the objective identified by P.L. 92-500.

Environmental controls were coupled with industrial manufacturing facilities in a cost-effective manner in 1974. This was accomplished by the development of pollutant recovery and reuse systems as well as by optimization of manufacturing process changes in lieu of end-of-the-pipe treatment technology. As a result, economic benefits were realized in the form of reduced treatment costs, savings in energy, raw material purchases, and overall reduced costs of manufacturing. In addition, significant reduction or elimination of toxic wastes using new treatment technologies which have industry-wide applicability achieved indirect cost-effectiveness.

Examples are macroreticular ion exchange/spent organic solvent regenerations and reductive degradation as applied to toxic materials such as endrin, heptachlor, chlordane, toxaphene, PCB's, DDT, aldrin/dieldrin, etc.

It was determined in 1973 and confirmed in 1974 that treatment technology state-of-the-art, as reflected by EPA's best practical technology (BPT) standards, falls substantially short of eliminating the discharge of pollutants to the aquatic environment. Serious issues have been raised concerning the economics of controlling toxic materials as well as proper disposal of residuals wastes. In 1974, efforts addressed some of the most environmentally critical areas which would have a significant economic impact on U.S. industry. The areas of highest environmental-economic impact are:

- The economic achievability of the proposed 1983 BAT guidelines.
- Adequate technology for pretreatment and areawide waste treatment management.
- The control of toxic discharges by industry.
- Marked reduction/elimination of residuals from pollution control systems.
- Establishing cost effectiveness of total environmental control systems wherein multimedia pollution processes are made compatible with each other.

Table VIII-3 indicates the diversity of industrial pollution control programs completed by 1974. The cost-sharing information is representative for this program area.

EXAMPLES OF CURRENT AND PAST COST-EFFECTIVE DEVELOPMENT AND DEMONSTRATION ACTIVITIES SPONSORED BY THE INDUSTRIAL POLLUTION CONTROL PROGRAM

Grantee	EPA Cost/Total cost	Objective	Results
City of Buffalo—N.Y.	60K/250K	Establish methodology for most cost-effective manner to achieve compliance with EPA regulations for municipalities handling industrial wastes.	On-going project will set a precedent as to the validity and workability of pretreatment standards.
Onondaga County—N.Y.	350/510K	Establish baseline criteria for post-construction evaluation of environmental benefits resulting from an area-wide wastewater management program.	1. Criteria established. 2. Control implementation is under construction. 3. Results show economic advantage for industry and municipality to join in effective control within a basin.
Volco Brass and Copper Co.—N.J.	124K/178K	Development and Demonstration of manufacturing process change, and end-of-pipe treatment for recovery of product and reuse of water.	1. Criteria established. 2. Annual savings of the pollution abatement effort: $2.61 per ton of finished wire.
Diamond Shamrock Corp.—Ohio (USDA Analytical Support)	35*K/35K 10*K/10K	Evaluation and assessment of exhaustive chlorination as cost effective resource recovery and reuse technique through chemical alteration/conversion of potentially toxic/hazardous chlorinated still bottom residues from organic chemical manufacturing.	Conversion of USAF Herbicide ORANGE, via chlorinolysis, to carbon tetrachloride, carbonyl chloride, and hydrogen chloride marketable products shown to be feasible. Teratogen "dioxin" destroyed/converted to below detectable limits (10 ppt). Toxicology of product CCl_4 negative. German process variant can also process at semi-works scale.
American Enka Co.—N.C.	283K/980K	Dev. and Demo. on effective and economically achievable technique to control the discharge of zinc from viscose rayon manufacture. Technique involved zinc recovery.	For a 2500-ton production plant the process demonstrated cost savings ranging from $116,000 to $465,000 depending upon the ratio of zinc used.
Farmers Chemical Co.—Tenn.	154K/220K	Dev. and Demo. of recycle technology for nitrogenous fertilizer plants. Previously no technology was available for suitable control of NH_3 wastes.	Demo. shows that NH_4NO_3 recovery and water reuse can be achieved with modest cost at 80% closed-cycle. Future efforts will be aimed at reducing net cost to zero. Currently recover 6,000 tons/yr NH_4NO_3 at $40-60/ton.
Del Monte Corp.—Calif.	Dev. 18K/20K Demo 50K/71K	Demo. of process modification to minimize waste generation resulting from fruit peeling operations.	For a 20T/hr dry caustic peeling unit, a net saving of $7.82/hr was realized.
Gold Kist, Inc.—Ind.	198K/283K	Optimization of water and waste management by in-plant controls in poultry processing.	Achieved up to $21,600/month reduction of sewer charges.
Institute of Paper Chemistry—Wis.	40K/150K	Developmental assessment of steam stripping and activated carbon process to reduce BOD from sulfite pulp liquor evaporation condensates with accompanying by-product recovery.	Economic feasibility established. Value of recovered products and savings in treatment costs exceed wastewater treatment cost by just under 6%.
Pacific Egg & Poulty Assoc.—Calif.	99K/151K	Pilot scale recycle of chiller wastewater to reduce BOD output, water use and refrigeration requirements.	Preliminary reports on this pilot effort indicate an expected reduction (approximately 60%) in chill water usage, about 30% savings in energy requirements for refrigeration, and about 6% reduction in fresh water.

NONPOINT SOURCE POLLUTION CONTROL

The research and development program for nonpoint source pollution focuses on the generation of management tools and source control technology for activities such as agriculture, construction, mining, and spills.

Evaluation of the status of knowledge relative to the magnitude and impact of land-originating, diffuse pollutants has indicated certain deficiencies. Studies are now under way to answer these questions. Specific projects include:

- Development of mathematical expressions to permit estimates to be made of the relative pollutant contributions to surface waters from various land use activities in watersheds.
- Utilization of these expressions to make a nationwide assessment of the severity of nonpoint pollution.
- Further development of management tools to evaluate the quantities of agricultural chemicals polluting surface waters as influenced by changes in climatic, edaphic, and land management factors.
- Evaluation of the pollution potential attendant with increased land application of animal wastes and with runoff from pasture and rangeland.

These studies are aimed at providing tools to the decision makers, such as areawide planning agencies or State pollution control agencies. The information should help them to evaluate the relative importance of nonpoint pollution within their jurisdictions and to establish reasonable control programs where necessary.

A second phase of activity on the nonpoint problem is the development of the techniques to be applied to those areas where control will be required. Evaluations of the effectiveness of various agricultural practices, such as cropping and soil disturbing methods, and animal waste management, to conserve soil and avoid water pollution are being made.

For further information on the nonpoint source control program, see Chapter VI.

EQUIPMENT AND TECHNIQUES PROGRAM

Research efforts have been directed to developing test procedures required under various sections of the Act. New and improved analytical methods for determining chemical, and microbiological pollutants have been or are being developed for use both in the field and laboratory. Specific developments and major activities through 1974-1975 include:

- Revision of the *Methods for Chemical Analysis of Water and Wastes* manual.
- Revision of the biological methods manual.
- Development of a microbiological methods manual.
- Completion of a demonstration project on computer automation of laboratory instruments to provide high efficiency analytical systems for water quality evaluation.
- Development of improved techniques for identification and quantification of indicator microbiological organisms.
- Development of improved fluorescent antibody techniques for the identification of microorganisms.
- Development of improved analytical techniques for the determination of pesticides and other organic and radiochemical pollutants.
- Improvement of the mass spectroscopic procedure for the identification of 25,000 potential water pollutants.
- Completion of evaluation of a hydrogen sulfide sensor for application to water quality measurements.

QUALITY ASSURANCE PROGRAM

An Agency-wide quality assurance program is being implemented to improve environmental data used by EPA to ensure the validity of the data. Key elements of the program are laboratory quality control and methods standardization.

Achievements and major research activities initiated through 1974-1975 include:

- Full implementation of the regulation for test procedures for the analysis of pollutants in wastewater discharges, implementing section 304(g) of the Act.
- Proposed revisions for the regulation for test procedures for the analysis of pollutants (40 CFR Part 136).
- Ongoing development and distribution of standard reference samples for demand analysis, nutrients, minerals, and trace metal analyses for internal quality control.

- Continuing methods validation studies for minerals, nutrients, oxygen demand analysis, trace metals, cyanide, and petroleum hydrocarbons.
- Completed evaluation of all EPA Regional laboratory and field monitoring support efforts and initiated similar evaluation studies of State laboratories involved in wastewater and water quality analyses.
- Completed a formal EPA laboratory certification feasibility study and initiated guidelines development for laboratory certification, inter-laboratory comparisons, on-site laboratory inspections, and laboratory survey protocols.
- Initiated development of guidelines for sampling and sample preservation and for data handling systems.

A Federal-State quality assurance program helps ensure the validity of environmental data used by EPA. *(EPA biologist prepares pesticide sediment sample.)*

DATA AND INFORMATION RESEARCH PROGRAM

Remote Sensing.—Efforts have been directed toward demonstration of environmental applications of existing remote sensing technology.

Significant achievements over the past year include:

- Providing technical support to the Agency in the remote sensing of oil spills and the cataloguing of environmental conditions and land uses.
- Development of a demonstration program for application of aerial multi-spectral techniques in surveys of waterbodies.
- Demonstration of operational aerial photographic and isothermal infrared capabilities for Regional outfall detection.
- Development of an environmental photographic interpretation system.

Lake Eutrophication.—The eutrophication threat to selected fresh water lakes and reservoirs in the United States is being assessed in conjunction with State water pollution control agencies and the National Guard. The Survey is aimed at developing lake water quality criteria and information concerning point and nonpoint sources of lake eutrophication and identifying possible restoration measures.

Major accomplishments during the past year include:

- Completion of all field work in the eastern U.S.
- Reporting of significant study findings for north central to northeastern U.S.
- Initiation of lake watershed sampling/analyses in mid-to-far-western States.

ENVIRONMENTAL MANAGEMENT RESEARCH PROGRAM

Engineering, economics, and the physical, biological, and social sciences, in conjunction with systems analysis techniques, are brought together in an interdisciplinary effort to develop improved environmental quality management methods. The program's goal is to provide decision-makers with data and techniques to improve the cost-effectiveness of local, regional, and national pollution control programs. Research areas include environmental quality forecasting and analysis, comprehensive planning, procedures to set and implement standards, cost and benefit analysis, and

envionmental impact analysis procedures. While the program focuses on managing the environment considered as a whole, it also provides management assistance directly applicable to water problems. Recent accomplishments include:

- A series of projects investigating alternative concepts for financing the various provisions of the Act.
- Development of procedures for States to use in designing a cost-effective permit compliance monitoring system.
- Demonstration of comprehensive metropolitan water quality planning.
- Analysis of the comprehensive management of phosphorus water pollution.
- Report on the use of environmental analysis of wastewater facilities by local government.
- Demonstration of a State water quality management information system.
- Demonstration of an assessment methodology for the environmental impact of water resource projects.
- Preparation of a bibliography of water pollution control benefits and costs.
- Development of procedures for meeting reliability and maintainability goals in ambient water quality monitoring networks.
- A cost-effectiveness analysis of control methods for agricultural nonpoint sources of pollution.

Other water quality management projects initiated or continued include:

- Preparation of a comprehensive Report to the Congress on the costs of implementing the Act (section 516(b)).
- Techniques for minimizing the intermedia impact of industrial residuals through reuse.
- Analysis of a wide range of standards options for control of groundwater quality.
- Analysis of the secondary impact of transportation and wastewater treatment investments.
- Development of a handbook to assist States in implementing optimal compliance monitoring procedures.
- Handbook to assist State and local planners in the selection of water quality models.
- Economic evaluation of implementation strategies for control of agricultural nonpoint sources of water pollution.
- An evaluation of current and potential economic incentives for land use control.
- Systems for wastewater reuse in metropolitan areas together with a methodology for allocation of limited water resources.
- Handbook to assist State and local planners in evaluating secondary impacts of wastewater systems.

TECHNOLOGY TRANSFER

Technology Transfer bridges the gap between research and full-scale operational use by evaluating newly developed successful technologies and transferring this knowledge to consulting engineering firms; municipal, industrial, and State design engineers; city managers; directors of public works; industrial managers; laboratory directors, conservation groups; and others concerned with design, construction, operations, and monitoring of pollution control facilities.

This program has completed additional design manuals and handbooks in the on-going series which now includes design manuals for carbon adsorption, upgrading existing wastewater treatment plants, phosphorus removal, suspended solids removal, sulfide control, nitrogen control, and sludge treatment and disposal, and handbooks for analytical quality control, monitoring industrial wastewater, and chemical methods of analysis. These major comprehensive publications have been widely distributed and used and are having a significant effect on environmental pollution control facilities. Additional manuals are currently under preparation for both the industrial and municipal areas.

The wastewater treatment seminar series continued in 1974 with the total cumulative attendance at the sessions now totaling over 10,000 engineers and plant managers. Eighteen publications evolving from the seminar series are now being distributed on a national basis to those unable to attend the seminar.

Waste Flow Reduction

The high cost of treating wastewater, and the environmental impact of treated wastewaters on the receiving waters, are major concerns of EPA. These, in addition to the needs of providing new water supplies and curtailing energy demands, make water conservation and sewage flow reduction measures an important consideration in water supply and wastewater treatment planning.

The Act calls for EPA to conduct research on devices and policies for reducing water consumption and the total flow of sewage. (Section 104 (o).) EPA's first investigations (reported in June, 1974) found potentials for reduction in water consumption and sewage flow in the home, in industry, and through infiltration/inflow control. Research has continued in all three of these areas.

THE CURRENT QUANTITY OF FLOW

Current withdrawals from the nation's waters exceed 370 billion gallons per day (bgd). Of this total, direct industrial withdrawals constitute 47 bgd and public water supply is 27 bgd. This report focuses on means for reducing this 74 bgd volume of water. Withdrawals for irrigation (130 bgd), livestock and rural uses (4.5 bgd) and steam-electric power plant cooling (170 bgd) are excluded from the discussion. While these categories are major ones (see Table IX-1), they do not involve public water supplies or require municipal or industrial wastewater treatment.

Industrial and commercial water supplies are primarily withdrawn directly (47 bgd); a smaller portion is obtained from public water supplies (9 bgd). Similarly, most industrial and business discharges go directly to the receiving waters, with only a small portion discharged to sewers (7.3 bgd.) (Table IX-2.)

Domestic users obtain about 18 bgd from public water supplies. Deducting the portions going to septic tanks, outdoor sprinkling, and other losses, domestic and municipal flows to sewers are estimated to be 10.6 bgd. Total municipal treatment plant flows are estimated to be 24.0 bgd. Deducting the above estimates of domestic and industrial

Table IX-1

TOTAL WATER WITHDRAWALS BY PURPOSE, 1970 (bgd)

Public water utilities		27
Industrial and commercial	9	
Domestic, municipal & losses	18	
Industrial and miscellaneous		47
Rural, domestic & livestock		4.5
Irrigation		130
Steam-electric utilities		170
Total		370

Source C R. Murray and E B Reeves, *Estimated Use of Water in the U S in 1970*, Geological Survey Circular 676, U.S Geol. Survey, 1972

TABLE IX-2

ALLOCATION OF PUBLIC WATER SUPPLIES AND AMOUNTS DISCHARGED TO SEWERS, 1970 (bgd)

	Water supply	Reaching sewers
Industrial and commercial	9.0	7.3
Industrial—large users	4.5*	2.8*
—small users	1.3***	1.3
Commercial	3.2**	3.2
Domestic, municipal and losses	18.0	10.6
Losses (10%)[1]	1.8	0.0
Municipal (10%)[2]	1.6	0.8
Residential with septic tank (10%)[3]	1.5	0.0
Sprinkling (25%)[4]	3.3	0.0
Domestic (in-house) use and sewage	9.8	9.8

**Water Use in Manufacturing*, 1968 and 1973 Interpolation

**Hirshleifer, et al , *Water Supply*, 1970. Based on ratio of commercial to industrial, p. 25.

****Water Use in Manufacturing* covers large users (over 20 million gallons per year). Small users' consumption is estimated as a residual after estimating commercial

[1]Hirshleifer, et al., estimate 10-15% (pp 27, 179).

[2]Hirshleifer, based on ratio of municipal to domestic, (p 25).

[3]Of the dwelling units served by public water supplies, 13% are on septic tanks (1970 Census). Water use in these homes is less than in those on public sewers.

[4]Estimate.

discharges, the residual infiltration and storm flow is estimated at 6.1 bgd.

TABLE IX-3
BREAKDOWN OF MUNICIPAL WASTEWATER FLOW

	Flow (bgd)	Percent
Total flow in wastewater facilities	24.0*	100
Industrial and commercial	7.3	30
Domestic	10.6	44
Residual: infiltration and storm flows	6.1	26

* Flow from municipally owned wastewater facilities in 1974 is estimated at 27 bdg (Municipal Waste Facilities Directory, 7/9/74, total of 24 7 bgd, adjusted for plants with no flow data) Three percent annual growth rate is assumed to estimate 1970 flows

In an effort to reduce the total quantity of wastewater generated and the demand for treated public water supplies, EPA is conducting research in the areas of sewer infiltration/inflow and industrial and home water conservation.

INFILTRATION AND INFLOW

Infiltration and inflow refer to water which gets into the sanitary sewer system through leaks in sewer lines, or from drains on buildings being connected to sanitary sewer systems. It is estimated above that infiltration/inflow accounts for up to 25% of total treatment plant flows; other estimates have been up to 30%.

The Act requires all new applicants for treatment works grants to demonstrate that each sewer system discharging into the proposed treatment works is not subject to excessive infiltration/inflow (I/I). EPA's construction grant regulation (40 CFR 35.927) and supplemental *Guidance for Sewer System Evaluation* (March 1974) implement the Act's mandate. The publications recognize that some infiltration/inflow costs more to correct that it does to treat. For these cases they insure that the I/I flows are reduced to the extent it is cost-effective to do so.

Basically, the grant regulations call for the following:

- *I/I analysis:* An in-depth study of the past records, rainfall and other pertinent information relative to the sewer system, to determine whether excessive I/I may exist.
- *Evaluation Survey:* When excessive I/I exists, a physical survey of the sewer system followed by detailed cost-effectiveness analysis.
- *Rehabilitation:* Physical correction of all I/I sources that are previously determined to be cost-effective to repair.

Of the 640 projects currently under I/I study, only 27% have excessive I/I. These projects, ranging in size from .04 to 200 million gallons per day flow, are presently under evaluation survey (task 2). Techniques for I/I study and correction are relatively new and complex. Therefore EPA is preparing a new technical bulletin describing I/I methodology for use as a guide by designers and municipalities. In addition, the National Environmental Research Center in Cincinnati, Ohio, is directing several projects on analytical methods and technologies relating to infiltration and inflow control, as follows:

Analysis of Practices for Preparing An Economic Analysis and Determining Infiltration

The American Public Works Association has received a grant to report on and prepare a manual of practice on the practices used to determine infiltration and inflow in sanitary and combined sewers, and develop a framework for economic analysis to determine whether or not infiltration should be reduced or pipe/plant size increased. The economic analysis will develop a manual of practice for unit costs of repair, replacement, or corrective action required to minimize infiltration and for the unit costs of the affected wastewater treatment facility.

Demonstration and Evaluation of The Use of Impregnated Concrete Pipe and other Methods of Infiltration Control

The Texas Water Quality Board has received a research grant from EPA to perform a demonstration and evaluation of impregnated concrete pipe. Corrosion of concrete sewer pipe is a major cause of leakage and failure in sewer pipes which results in infiltration. A method of impregnation to increase the corrosion/erosion resistance, impermeability and strength of concrete pipe has been developed under another EPA-funded study. This study will further evaluate the performance of the new method.

Trenchless Sewer Construction And Sewer Design Innovations

EPA has funded a research project in the town of Bethany Beach, Delaware, to evaluate trenchless sewer construction. The project will demonstrate a new sewer construction method which promises to be less costly and more rapid than conventional construction and will overcome the problems of high water table, unstable soil, associated infiltration and expensive manhole construction. A thorough two year post-construction evaluation is to be included.

HOME WATER CONSERVATION

Public water supply, the major source of the homeowner's water, is responsible for only about 7% of total U.S. withdrawals. At first glance, therefore, home water use does not seem very significant. However, water for public supplies is costly to provide. Often it must be conveyed for long distances. Before use, it must be treated to potable quality, and after use it must be treated again before being returned to the environment. Thus, public water supplies and municipal treatment are important both economically and environmentally. Individual households account for an estimated 60% of delivered water and generated sewage.

Interest in home water conservation is growing. Particularly where public water supplies are diminished to critical levels or where sewage treatment capacity is limited, public discussions and other activities are increasing. Because water supplies and sewage treatment capacity remain readily available and inexpensive in many areas of the country, however, this interest is not universal.

The major ways to reduce household water use and sewage flows are through water saving devices and user charge policies.

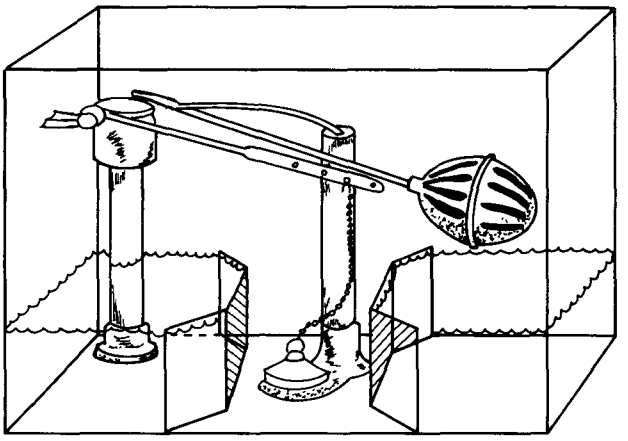
Water Saving Devices

A considerable amount of research has been and is being conducted on water-saving devices. From individual inventors to major plumbing manufacturers, industry is responding to the flow reduction objective.

A number of devices have been developed that can be retrofitted to existing plumbing fixtures and appliances. Tests show that many of the devices perform acceptably, are simple to install, and save enough water to make them worthwhile. Many of these home water saving devices are commercially available.

Other research, conducted for the most part by manufacturers, has concentrated on the development of completely redesigned water saving plumbing fixtures and appliances. These fixtures generally perform better than conventional retrofitted fixtures, but their higher cost makes them practical principally for new installations or replacement of non-working units. A number of water-saving plumbing codes, such as that instituted by the Washington (D.C.) Suburban Sanitary Commission, require the use of water-saving fixtures for new or replacement installations.

Figure IX-1.



Damming devices, which hold back some of the water in a toilet tank, reduce the amount used in flushing and thus save water.

Much of the credit for the rising interest in home water conservation goes to the efforts of concerned public utilities. The Washington Suburban Sanitary Commission, for example, has been extremely active in promoting conservation by its customers. Beginning in 1970, the WSSC has run public education programs, tested and demonstrated water saving devices, revised its plumbing code, distributed displacement bottles for toilet tanks and shower flow-restricters to its customers, and more recently has begun an extensive education program in the elementary schools. This program has served as a model; other utilities, such as the Marin County (California) Municipal Water District have instituted a program similar to the WSSC's. The adoption of these devices depends to a large extent on whether or not the savings in water and wastewater bills, generally rather low, provide an incentive for the homeowner to incur the cost of capital outlay for aquisition and installation. Some data on water savings and costs of such devices have been specified in previous publications of EPA, and further guidance is being prepared.*

*Federal Water Quality Administration, *A Study of Flow Reduction and Treatment of Waste Water from Households.* James R. Bailey, *et. al.*, Washington, D.C. 1969 NTIS PB 197-599.

U.S. Environmental Protection Agency, *Demonstration of Waste Flow Reduction from Households*, Report No. EPA-670/2-74-071. National Environmental Research Center, Cincinnati, Ohio. 1974. NTIS PB 236-904/AS.

SAVING WATER IN THE HOME

The most promising areas for inside the house water saving with devices appear to be the toilet and the shower. Toilet flushing and bathing account for approximately 39% and 34% respectively of inside water use. A number of workable methods have been developed to reduce the amount of water used in toilet flushing. The simplest devices are displacement or damming devices which hold back some of the water in a conventional toilet tank and thus reduce the amount of water used in a flush. Slightly more complicated are dual or regulated flush devices which allow the user to select a small flush for liquid waste and a larger one for solid waste. Another alternative is a completely redesigned toilet which uses less water for a flush. Toilets which use water more efficiently are now readily available to consumers and are in fact required in some places for new installations or replacements. Other toilets have been designed which use little or no water at all. These include vacuum toilets, chemical toilets, incinerator toilets and composting toilets. The expense, complexity and in some cases the inconvenience of these units make them practical primarily in extremely water short areas or in areas which do not have public water supplies and sewers.

Second to the toilet, the largest controllable in-house water use is the shower. Conventional shower heads use between 5 and 15 gallons per minute. In a leisurely shower, the high flow can use large amounts of water, all of which goes into the sewer. Redesigned shower heads can reduce flows to three gallons per minute or less and provide even a sybarite with a pleasurable shower. These shower heads are usually not expensive and can pay for themselves in water savings to the consumer (when the consumer pays for water on the basis of use). Other devices, which are more expensive, allow the user to shut off the shower flow at the shower head while soaping up then turn it back on without disturbing the temperature adjustment. A simple, cheap and easily installed device, designed by Virginia Polytechnic Institute, consists of a plastic insert which, when installed in a showerhead, reduces the flow to 3.5 gallons per minute. These devices were distributed by the WSSC to all of its customers who wanted them and they appear to be performing acceptably. A similar device has been developed to reduce flow in other types of household faucets.

Pricing Policy and Rate Structure

The Flow Reduction Potential.—Basic to the efficient use of resources is the idea that consumers should pay a price that reflects the cost of the good or service being provided. Pricing policy and rate structure for water and sewage service can help in achieving a cost-efficient level of conservation.

EPA is directly involved in the question of municipal pricing policies. In order to qualify for a construction grant under the 1972 Act, grant applicants must agree to adopt a policy of user charges for sewage service. The main purposes of such user charges, according to EPA guidelines, are (1) to distribute the cost of operation and maintenance of publicly owned treatment works to the pollutant source, (2) to achieve self-sufficiency of treatment works with respect to operation and maintenance costs, and (3) to provide for recovery of capital costs for the portion of capacity funded by the Federal government and utilized by industry.

A fourth purpose which a user charge system *can* fulfill is that of encouraging the conservation of water and reduction of wastewater flows. However, the Act does not require that this function be served by the user charge system instituted by grant applicants. Rather, it is designated in section 104(o) as a matter to be studied. Whether or not the fourth purpose is achieved hinges on two questions: are charges based on flows, and are charges set to reflect incremental costs?

Metering and Billing—To encourage conservation through the user charge system, users must

be metered and the user charge system must include a cost component based on individual flows. For example, a "flat-rate" monthly charge per dwelling unit might serve the purpose of allocating treatment costs among users, but it would not reward a householder for producing less wastewater—or penalize him for producing more—than the average. If his water and sewage use rises, he essentially pays a zero price for the added amount: he has no incentive to conserve.

In some situations, it may not be worth attempting to achieve conservation through the price system: the savings in terms of water and wastewater costs may be less than the required expenditures in terms of other resources—e.g., the cost of metering and billing. However, demand elasticities suggest that pricing is a generally promising approach (see "The response to incremental costs," below).

Analysis of pricing requires consideration of both water and sewage, for two reasons. First, although the outdoor (sprinkling) use of water does not affect wastewater flow, the in-house (domestic) use of water and sewage are, in economic terms, complementary services—consumer use depends on the prices of both. Secondly, the two are related in terms of measurement technique. Meters to measure sewage flow directly are expensive and seldom used, but such flows can be estimated from the metered use of water. Where sprinkling use of water is substantial, for example, water use during winter months has been used to provide an estimate of domestic water use (and hence sewage flow). Thus, the availability of water meters permits sewage charges also to be based on flow.

Metering and billing for water supply is widespread. Perhaps 75-80% of the public water supply through-put in the U.S. is metered. A large part of the unmetered use occurs in several large cities—New York, Chicago, St. Louis, Denver (now undergoing metering) and Portland, Oregon—where large commercial and industrial users tend to be metered, but single family residences, and sometimes apartment houses, are not.

Where water meters are used, sewage bills are frequently based on flows, either through a charge directly related to flow or through calculating the sewage bill as a fraction of the water bill. A survey taken for EPA indicates that either form of sewage flow charge is used by about 67% of the agencies for residences and even more frequently for multifamily dwellings (72%), commercial (85%) and industrial (87%) users.

In general, it seems that water bills are higher than sewage bills. Though there is considerable variation with city size, etc., for water the typical monthly residential bill indicated in 1970 data is over $4, for sewage about half as much. The typical flow charge for water for that date is on the order of 40¢ per thousand gallons in the last price block; for sewage charges data is not available.

Improving the Techniques.—The figures indicate that, in a majority of municipalities, billing gives some incentive for water conservation and waste flow reduction. However, most utilities are required to set their rates in terms of average, historical costs. In contrast, to promote the efficient use of water and sewer services, prices at the margin (the last block rate) would be equal to the incremental cost of providing the service.

The implications of this approach for water and sewer pricing are far from thoroughly developed, but would frequently imply that prices at the margin should be higher than at present. For example, in many areas, incremental unit costs of new water supplies are greater than average historical costs.

For many waste treatment plants unit costs decline as capacity increases, because of economies of scale. Here, the incremental costs might be less than average costs. However, as many as half of all treatment plants are located on water quality limited streams, where an increase in sewage flows requires progressively higher levels of treatment—and, very likely, increasing unit costs. Therefore, unit sewage charges greater than average costs may frequently be appropriate. In these cases, where incremental unit costs are increasing (in constant dollar terms), the policies generally followed by utilities fail to discourage excess use of water and sewage.

As a dramatic example, Southern California is an extremely arid area with large water demands. New water supplies have to be brought great distances at great cost, yet unit charges for water appear to be no greater than in the rest of the country. Because a large part of the cost of water supply is covered by a property tax, water rates do not even cover average costs, let alone incremental cost.

Response to Incremental Costs.—The feasibility of flow reduction through metering and pricing depends to a large extent, of course, on the responsiveness of users to increased charges — the

elasticity of demand. In the most thorough analysis of this question to date, the elasticity of demand for water used for sprinkling was fairly large; for domestic (in-house) use, the elasticity of demand was smaller, though still significant.

The elasticity estimates are:

- Sprinkling use in dry western areas: .7% use decrease per 1% price rise
- Sprinkling use in humid areas: 1.6% use decrease per 1% price rise
- Domestic users overall: .23% use decrease per 1% price rise

These elasticity estimates apply to small price changes. For larger changes, of the magnitude often called for, the effect must be calculated from the demand equations. Illustrative cases of doubling the flow charge from 20¢ per 1000 gallons to 40¢ per 1000 gallons might result in a 40% reduction in sprinkling use in the west and a 10% reduction in domestic use. Hence, the elasticity of demand for water appears sufficient to warrant careful attention to pricing policy.

Summary.—Legislation and regulation of user charges is directed primarily toward an equitable allocation of costs, and toward self-sufficiency of wastewater agencies. For example, the Agency has proposed that ad valorem charges be permitted to continue where these goals can be met (Appendix C). However, EPA is also studying user charge policies designed to encourage the economic use of water supply and wastewater services.

INDUSTRIAL WASTE FLOW REDUCTION

Industry is, of course, one of the primary sources of water pollution, directly withdrawing and discharging massive amounts of water, as well as being a significant user of public facilities. (Tables IX-1, IX-2, and IX-4) Because of this importance, EPA maintains a broad program to develop industrial pollution control technology. Many of the projects are specifically related to internal recycling, a primary technique in reducing industrial waste flow. For many industries, the high cost of end-of-pipe treatment, the economies of treating more concentrated waste, and rising water supply costs have made recycling and other methods of improved water management economically attractive.

The latest census of water use in manufacturing indicates that recycling has increased rapidly in recent years. The extent of recycling is indicated by the ratio of gross water use (intake plus recycled water) to water intake. This ratio was 2.31 in 1968 and 3.13 in 1973—indicating a 35% increase in water use per gallon of intake over the 5-year period. This increase is greater than that in earlier inter-census periods and may account for the fact

TABLE IX-4
WATER USE IN MANUFACTURING, 1973 (BGD)*

	Fresh	Brackish & salt	Total
Intake by source			
Public water systems	4.5	0.0	4.5
Company water systems			
Surface	23.8	1.2	25.0
Ground	4.2	0.4	4.5
Tidewater	1.0	6.1	7.1
Total	33.4	7.7	41.2

	Flow (bgd)	Percent
Discharge by type		
Public utility sewer	2.8	7.3
Streams and rivers	24.9	64.2
Lakes and ponds	3.3	8.6
Bays and estuaries	6.2	16.1
Ocean	0.5	1.2
Ground	0.6	1.5
Transferred to other uses	0.5	1.2
Total	38.8	100.0

	Flow (bgd)	Percent
Purpose of intake		
Process	10.8	26.3
Steam electric power generation	7.5	18.1
Air conditioning	0.8	1.8
Other cooling and condensing	19.8	48.1
Sanitary service	0.6	1.4
Boiler feed and other uses	1.8	4.3
Total	41.2	100.0

**Water Use in Manufacturing, 1972 Census of Manufactures*, Bureau of the Census Data cover establishments using over 20 million gallons per year, estimated to account for 97% of water use Details in some cases do not add to totals because of rounding The water withdrawals given here are less than those in Table IX-1, because mining is excluded here and perhaps because of other differences in the method of estimation. Power generation here refers to that in industrial plants

TABLE IX-5
WATER INTAKE AND RECYCLING IN MANUFACTURING*

	Water intake (bgd)	Gross Water use (bgd)	Ratio gross use/ intake	Change in ratio
1954	31.7	57.6	1.82	
1959	33.2	71.9	2.16	18.7%
1964	38.3	81.6	2.13	-1.4%
1968	42.3	97.5	2.31	8.5%
1973	41.2	128.7	3.13	35.5%

**Water Use in Manufacturing*, 1973, p SR4-7

that in the 1973 census, for the first time, water intake in manufacturing declined (Table IX-5).

A number of research projects related to water conservation and waste flow reduction were discussed in the last Report to Congress. Those discussed here are those which are presently under way, or were completed in 1975.

Research being conducted in the food and kindred products industry is of particular interest in terms of wastewater flow reduction. It is estimated that over 21% of the total national manufacturing pollution load is contributed by this group of industries. More importantly from a waste flow reduction standpoint, in 1973, 30% of the wastes of this industrial group was discharged to municipal sewer systems. Thus, while other industrial groups use more water, this group discharges more wastewater to municipal systems. Clearly, the studies done in the food and kindred products industry offer significant potential for lowering industrial wastewater flows to municipal systems. These studies, which illustrate the type of research being carried out in the industrial area, are the following:

Tomato Cleaning and Water Recycle
National Canners Association
Washington, D.C.

This study will demonstrate low water use cleaning of tomatoes and recycling of the tomato transport water. Water use for cleaning should be reduced from the present 700 gal/ton to 6 gal/ton. In combination with the recycle system the water use for receiving and cleaning should be reduced from 930 gal/ton to 120 gal/ton.

Reuse of Treated Fruit Processing Wastewater Within a Cannery
Snokist Growers
Yakima, Washington

This study will evaluate the feasibility of reclaiming end-of-pipe process wastewater for reuse within a fruit cannery. Reuse of the reclaimed water will be evaluated for a variety of different uses within the plant including cleaning, cooking and cooling.

Integrated IOB Vibratory Blanch Cooler for Reducing Pollution Caused by Blanching of Vegetables
American Frozen Food Institute
Washington, D.C.

This study will evaluate on a proto-type scale, a new type of system in which the steam condensate from the vegetable blancher (IOB) will be utilized for spray cooling of the product prior to freezing. Significant reductions in liquid effluent volume (90%), and in the organic (70%) contained therein should be demonstrated when compared to current industrial practices.

Poultry Processing Wastewater Reuse Effects on Product and Water Safety
Maryland State Dept. of Health
Baltimore, Maryland

This project is to evaluate the safety for human consumption of poultry processed in a plant utilizing reclaimed wastewater in a closed loop water system. The poultry plant will recycle about 50% of their own processing wastewater. Safety will be determined by relative amounts of contaminants before and after recycling begins.

Egg Breaking and Processing Wastes
Cornell University
N.Y. State College of Agriculture and Life Sciences
Ithaca, New York

This project intends to determine the magnitude of the shell egg and egg breaking and processing waste problem and to explore waste management methods that are applicable to these wastes. One of the major objectives of this project is identify opportunities for in-plant waste reduction and water reuse.

Ecostatic Cane Processing System
C. Brewer and Co., Lmt
Hilo Coast Processing Co.
Pepeekeo, Hawaii

This project involves a full-scale demonstration of sugar cane harvesting and processing with water reuse and solid waste recovery which will result in major reductions in wastes discharged.

Characterization and Reduction of Specific Wastewaters from In-Plant Hog Processing Units of the Meat Industry
University of Wisconsin
Madison, Wisconsin

This project will characterize wastewater from critical unit operations in hog slaughtering and associated cleaning processes, and will develop and demonstrate methods and equipment for reduction of the flow and waste load from these unit operations.

Minimization of Water Use in Leafy Vegetable Washers
Dulaney Foods Inc.
Eymore, Virginia

This project involves the installation of a full-scale experimental leafy green vegetable washer on a commercial processing line. Performance of the experimental, water saving unit will be monitored and compared with that of conventional vegetable washers.

Shrimp Cannery Wastewater Treatment Demonstration Project
American Shrimp Canners Association
New Orleans, Louisiana

An in-plant water conservation and management program will be instituted along with several possible process modifications. The resulting effluent will be treated (plant scale) by screening and dissolved-air flotation with chemical addition. Screening and sludge will be processed for ultimate disposal.

Other industrial groups where studies are being conducted in the water conservation and waste flow reduction area are the chemicals and allied products industry; the pulp, paper, paperboard, lumber and wood products industry; the textile mill products industry; and the metal and metal products industry. Most of the studies in these industries that relate to waste flow reduction concentrate on recycling the water used in the plant.

For each of the industrial groups mentioned above one representative study will be discussed.

Treatment of Petrochemical Wastewater for Reuse
Union Carbide Corporation
New York, New York

This project will develop feasibility, design, and economic data on petro-chemical wastewater upgrading and subsequent reuse by testing a pilot-scale system comprising an integrated sequence of the most promising treatment steps for upgrading bio-treated petrochemical effluents for use in pilot-scale heat transfer systems.

Aircraft Factory Waste Water Recycling, Pilot-Scale Demonstration

Boeing Commercial Airplane Co.
Seattle, Washington

The objective of this program is a pilot-scale demonstration of treatment and recycle of four dilute wastewater streams resulting from aircraft manufacture. Both recurring and non-recurring costs of a full-scale recycling plant will be determined.

Pollution Control Facilities, Textile Mill
J.P. Stevens & Co. Inc.
Greensboro, North Carolina

One objective of this project is to produce an effluent from a synthetic fabric finishing plant which will have a 5-day BOD and suspended solids of 5 mg/l or less and minimum dissolved oxygen of 5 mg/l using multi-media filtration. A second objective of the project is to determine the feasibility of wastewater reuse in the manufacturing process.

Water Reuse in a Paper Reprocessing Plant
Big Chief Roofing Company
Ardmore, Oklahoma

This project is concerned with the treatment of paper reprocessing wastewater in a facility designed for water reuse. The economic feasibility of wastewater recycle and various treatment alternatives will be determined from lab and full-scale tests.

Public Participation and Advisory Groups

PUBLIC PARTICIPATION— "THE SINGLE MOST IMPORTANT INGREDIENT"

EPA is unique among Federal agencies in the scope of its public participation responsibilities. No Agency has received a broader Congressional mandate to encourage public involvement in a program than did EPA in section 101(e) of the 1972 FWPC Act amendments. The Act requires that the Agency encourage, assist and provide for public participation in virtually every significant aspect of the water program.

This commitment to public involvement, which EPA Administrator Russell E. Train has called "the single most important ingredient in the environmental management process," requires much more than traditional forms of public involvement. Imaginative new programs which actively promote public activism are essential. If reaching the public by tape cassette— a creative, successful approach developed in EPA Region V— is more effective than the printed word, then tapes should be used. Furthermore, more innovative programs should be attempted. Unfortunately, while several new programs have been created, much remains to be done.

Continuing Programs.—Some agency public involvement activities, though traditional, are still essential to a sound public participation program. Through its Public Affairs Offices, the Agency distributes more than fifteen booklets and pamphlets explaining the water program and informing citizens about means for involvement. The Agency and the States have conducted numerous public hearings, as required by law or requested by citizens, dealing with all major programs in the Act. During 1974, public meetings included:

- State Program Plans (in seventeen States).
- The Construction Grants Program (all States).
- The State Basin Plans (sixty meetings across the nation).
- The Areawide Waste Treatment Plans (twenty-seven hearings).
- Industrial Permits (approximately one hundred hearings).

EPA also utilizes a wide range of advisory committees to promote continuing consultation between its program officials and public or private interests affected by the water program. Among the most active of these is the Committee of Ten, formed in 1972 to bring together State water planning officials with Regional Administrators, Deputy Regional Administrators and senior EPA Headquarters staff for discussion of water pollution programs. Committee members, each representing an EPA Region and selected by constituent States in each Region, consult with State officials before and after Committee deliberations. The Committee, working also through numerous subcommittees dealing with each major program in the Act, assures continuing communication between EPA officials at all levels and local interests affected by Agency activities.

A New Direction.—Publications, public hearings and advisory committees, however, are not enough to satisfy the requirements of section 101(e). In an effort to communicate directly with the public and activate its interest in water programs, several more innovative public participation activities in addition to the tape cassette program were planned and implemented during 1974.

Among the most successful was a three-phase public involvement program begun in 1974 with "Water Quality Training Institutes" conducted in each Region by the Conservation Foundation under an EPA grant. The Institutes, attended by 863 individuals representing a variety of public and private groups, informed participants about the goals and procedures of the water program in great detail and with particular attention to methods of citizen influence. To intensify the Institutes' impact, follow-up "Workshops", organized by Institute participants, were held in each State; more than 8,000 individuals attended 105 Workshops. The final phase, an Awareness/Information Program, will bring the activity to local communities.

During 1975, forty-six program leaders and 36 groups will work to stimulate local interest in the Act. This program is aimed especially at non-environmental groups—those commonly least attuned to water pollution control activities. Leaders in the Awareness/Involvement Program accept a responsibility to speak formally to at least twenty such organizations within their area of geographical responsibility.

Despite such useful programs, much more should be done. The public is vitally affected by the program but often cannot readily understand its complexities. In particular, "translating" the program into layman's terms and involving the public in the early planning stages of policy—as the Act requires—involve sustained, face-to-face contact between the public and program officials.

More Must be Done.—What more could be done? Special participation activities tailored to specific programs could be organized as such programs assume particular national importance. Within the next two years, for example, extensive planning for areawide waste treatment programs will be conducted across the United States, and public participation will be a major program objective.

EPA is currently encouraging designated 208 agencies to seek out actively the publics affected by their program and to explain its implications in terms readily understandable to laymen. About 7.5% of the $163 million granted to these agencies for areawide waste treatment planning will be allocated for public involvement activities—a potentially important source of funding for such a pro-

A concerned public is essential to the nation's clean water goal. *(Fly fishing in salmon stream below paper plant east of Bangor, Maine.)*

gram. The innovative programs so far accomplished suggest the constructive possibilities in public participation as envisioned by section 101(e). The challenge is to bring these activities closer to the objectives of the Act in quality and variety.

ADVISORY COMMITTEES

ES +WQIAC

The Effluent Standards and Water Quality Information Advisory Committee (ES + WQIAC) is a statutory committee created under section 515 of the FWPCA and rechartered under section 9(c) of the Federal Advisory Committee Act.

The legislative mandate of the Committee was to provide and evaluate scientific and technical information on industrial point source discharges and toxic effluents, and to transmit this information to the Administrator for his use in fulfilling the obligations of sections 304(b), 306, and 317(a) of the FWPCA.

During the fiscal year the committee has:

- Continued an ongoing review of effluent limitations for possible review and updating.
- Conducted a series of meetings with public interest groups on the economic implications and environmental impact of FWPCA.
- Made recommendations to the Assistant Administrator for Research and Development on ways to improve agency capability to meet the requirements of FWPCA.
- Published special reports on toxic substances, information utilization by EPA, and a report to the House Committee on Public Works on ES + WQIAC's first year activities.
- Made available to EPA, Federal agencies, individuals, law firms, and public interest groups information developed by the above activities and other committee research, hearings, conferences, and seminars.

Water Pollution Control Advisory Board

The Water Pollution Control Advisory Board was created by section 503 of the FWPCA. The Act mandates that the Board advise the Administrator on policy issues arising under the FWPCA.

The Board held its final meeting from July 16-19, 1974, in Seattle. Based on the meeting and presentations by interested persons and representatives of private industry, trade associations and public interest groups, the Board made the following recommendations:

- That EPA adopt more flexible effluent guidelines: the Board concurred with ES + WQIAC's recommendation that a matrix approach be adopted.
- That EPA speed up processing of construction grant applications, thus reducing construction cost increases pending grant approval.
- That EPA make a special effort to increase the efficiency of information transfer to private industry.
- That EPA transfer enforcement of FWPCA to the States as soon as possible.
- The Board opposed adoption of any Federal land use plan amounting to a Federal zoning law.

The Water Pollution Control Advisory Board was not rechartered under the Federal Advisory Committee Act. The Board terminated as of January 1975.

Compliance Through Federal Procurement Activities

INTRODUCTION

Section 508 of the Federal Water Pollution Control Act, "Federal Procurement," is designed to utilize the contract, grant and loan authorities of all agencies of the Federal government as a means of encouraging private citizen compliance with the Act. The section requires the President to submit an annual report to the Congress on measures taken in compliance with the purpose and intent of this section. This Appendix is submitted in response to that directive.

LEGAL AUTHORITY

Section 508 provides two distinct mechanisms for promoting compliance by private citizens with the provisions of the FWPC Act. First, section 508(a) prohibits any Federal agency from entering into any procurement contract with any person who has been convicted of a criminal offense under section 309 of the Act, if the contract is to be performed at any facility at which the violation giving rise to the conviction occurred and if the person owned, leased or supervised the facility.

In addition, section 508(c) directs the President to issue an Executive Order requiring each Federal agency to utilize its contract, grant and loan processes to effectuate the purposes of the Act and to set forth procedures, sanctions, penalties and such other provisions as the President determines necessary to carry out the section. The President is empowered (section 508(d) to exempt any contract, loan or grant from the provisions of the section on the basis of paramount national interest.

Section 508 is comparable to the language of section 306 of the Clean Air Act, as amended (40 U.S.C. 1857 *et seq.*).

EXECUTIVE ORDER 11738 AND IMPLEMENTING REGULATIONS

The President issued Order 11738, mandated by section 508(c), on September 10, 1973. This order supersedes E.O. 11602, issued under the Air Act. It uses the same language as the prior Order but is applicable to both the Air and Water Acts.

Section 5 of Executive Order 11738 requires the Administrator to issue implementing rules and regulations. Regulations implementing the air requirements were promulgated in the *Federal Register* on December 27, 1973 (40 C.F.R. part 1538, F.R. 35310). On April 16, 1975, EPA promulgated regulations to revise the previously promulgated air regulations and incorporate appropriate provisions of section 508 and Executive Order 11738. These regulations essentially repeat the requirements of the December 27, 1973, air regulations but make them applicable to both the Air and Water Acts. The regulations provide for the establishment of a List of Violating Facilities. This list will identify any facilities that are ineligible for use in a Federal contract, grant, or loan for reasons associated with the Clean Air Act or the FWPC act.

The regulations' bases for listing a facility are not limited to Federal criminal convictions. (See

Description of Program, below.) EPA believes that both section 508(c) of the Act and sections 1, 5, and 7 of the executive Order call for expansion of the bases for listing beyond that narrow ground.

First, section 508(c), which calls for the executive order, is independent of section 508(a): it refers to both contracting and assistance activities and vests the President with broad authority to carry out the purposes of the section. In contrast, section 508(a) refers only to one, non-discretionary basis for listing i.e., a Federal criminal conviction, and it pertains only to contracts.

The Executive Order is also consistent with the wider approach. Section I defines the purposes of section 508 broadly as "to assure that each Federal agency . . . shall undertake procurement and assistance activities in a manner that will result in effective enforcement of the Water and Air Acts." Section 5 directs the Administrator to issue rules and regulations as he deems necessary and appropriate to carry out the purposes of the order, and section 7 further authorizes the Administrator to take appropriate action in cases of noncompliance.

Thus, both section 508(c) of the Act and various sections of the executive order authorize the Administrator to go beyond the one mandatory basis of listing facilities which violate the Act. The Administrator's regulations reflect the broader reach of the program.

PROGRAM DESCRIPTION

EPA is required by its regulations to publish in the Federal Register and periodically revise the List of Violating Facilities. The program established in the regulations published on April 16, 1975, was made effective to contract, grant and loan activities of all Federal agencies as of July 1. The listing relates strictly to the facility, not to the entire company. Only the specific facilities listed by EPA will be ineligible for Federal contracts, grants and loans.

Facilities will be listed upon a determination by EPA of continuing or recurring noncompliance with clean water (or air) standards. Any facility giving rise to a Federal criminal conviction must be listed, in keeping with section 508(a) of the Act. Facilities may also be listed as a result of State or local criminal conviction or Federal, State or local civil adjudication or administrative finding.

The program applies to any contract, subcontract, grant, subgrant, or subloan in excess of $100,000 as well as any contract of a lesser amount involving a facility listed on the basis of a Federal criminal conviction.

When Federal criminal conviction is the basis for listing, removal will not occur until the Administrator certifies that the condition which gave rise to the conviction has been completely corrected. For State and local criminal convictions and Federal, State and local civil adjudications or administrative findings, removal will not occur until EPA enters into an approved plan of compliance which will ensure the condition which gave rise to the listing has been corrected.

In order to insure due process, no facility will be listed until its representatives have been afforded an opportunity for a Listing Proceeding, at which time the representatives may confer with and present information to the Director of the Office of Federal Activities, EPA. If a request to de-list is denied, representatives of the facility will be afforded a hearing before an EPA hearing officer, with a fair opportunity to present evidence and cross-examine witnesses.

It must be emphasized that this program is an additional arm of the EPA enforcement effort. It is primarily designed to encourage voluntary compliance, not to penalize a facility.

IMPLEMENTATION WITHIN THE FEDERAL ESTABLISHMENT

Each Agency of the Executive Branch is obligated under section 4 of the Executive Order to implement the listing program through its contract, grant and loan activities. Implementation involves amending the Federal Procurement Regulations (FPR), the Armed Services Procurement Regulations (ASPR), and any supplemental or comparable regulations, as well as maintaining close coordination with EPA to insure that requirements of the program are fully carried out.

The FPR (which guides civilian agencies), ASPR and NASA and ERDA procurement regulations have now been amended. Various agency grant and loan provisions have also been amended to carry out the requirements of the program.

Contact points within each Federal agency have been identified to receive EPA's List of Violating Facilities. The list will be distributed periodically and, to insure prompt implementation, every time a new facility is added to the list.

Under the FPR and ASPR contract provisions each bidder must certify when bidding on a particular contract that he is not on EPA's List of Violating Facilities and that he will promptly notify the contracting officer of the receipt of any communication that he is under consideration for listing. If a particular basis for listing has been identified against a facility but the facility is not on the EPA list, the Director of the Office of Federal activities, EPA, may request that an award of a particular contract be withheld for a period not exceeding fifteen days pending completion of an investigation.

The contract provisions also require that contractual provisions be inserted in every non-exempt Federal contract. The contractor must agree that no portion of the work will be performed at a facility on the EPA list; that he will comply with the clean water (and air) standards issued prior to the contract award as well as with the recordkeeping and inspections requirements under the Air and Water Acts; that he will use his best efforts to comply with clean water (and air) standards where the facility has not been listed prior to award; and that the contractor will insert these same requirements in any non-exempt subcontract. This last provision illustrates the reach of the program to cover all subcontractors.

These same requirements have been inserted in various agency regulations covering grants and loans.

It is emphasized that the awarding agency must determine whether the solicitation and contract provisions are being followed, and that each agency of the Federal government can assist in the effectiveness of the program by encouraging contractors to comply with clean water and air standards. Also the head of each agency has a responsibility to ensure that all officers and employees of his agency involved in the contract, grant, or loan process be familiar with the regulations. To further assist EPA in implementation, the head of each agency has a responsibility to report promptly to EPA any conditions in a facility which may involve noncompliance with water or air standards.

☆U S GOVERNMENT PRINTING OFFICE· 1977 O—593-021